GOVERNMENT OF NEPAL

AIRCRAFT ACCIDENT INVESTIGATION COMMISSION

FINAL REPORT

OF

9N-AHH TWINOTTER (VIKING DHC6-400) AIRCRAFT ACCIDENT
OPERATED BY TARA AIR PVT LTD
AT
SOLIGHOPTE, DANA VDC MYAGDI DISTRICT, NEPAL
ON
24 FEBRUARY 2016

SUBMITTED BY:

COMMISSION FOR THE AIRCRAFT ACCIDENT INVESTIGATION
TO
THE GOVERNMENT OF NEPAL
MINISTRY OF CULTURE, TOURISM AND CIVIL AVIATION
31/07 /2016 (2073/04/ 16 B.S.)

FOREWORD

This report on the accident of 9N-AHH, DHC-6/400 aircraft (flight number TA-193) operated by Tara Air, Nepal is based on the investigation carried out by the 'Accident Investigation Commission' duly constitutedby the Government of Nepal on 25th February 2016 as per the provision of the Aircraft Accident Investigation Regulation 2014 (2071 B.S.) and article-26 of Chicago Convention. The main objective of the investigation is to find out the cause of the accident and suggest recommendationsto prevent the recurrence of such kind of accident in the future. Thus, it is not the function of the Commission to apportion blame or determine civil or criminal liability since neither the investigation nor the reporting process has been undertaken for that purpose.

The Commission adopted standard methodology and resources in compiling this report including technical information on the aircraft, relevant documents, existing rules and regulations, crash site examination, meteorological reports, and direct interviews with other flight crew, eye-witnesses & other personnel. The commission conducted in depth study and extensive analysis of all available information, evidences, records, documents and made appropriate references to numerous previous reports prepared by different air accident bodies/ commission.

Composition of Commission:

1. Mr. Rajesh Raj DALI (Former DG CAAN) - Chairman
2. Colonel (Er.) Dipak Prasad BASTOLA -Member
3. Captain Srawan RIJAL -Member
4. Er. Ram Prasad KOIRALA -Member
5. Joint Secretary Suresh ACHARYA -Member Secretary

Experts to the Commission:

1. Dr. Jagadishwor Karmacharya, DHM
2. Dr. RanjeetSingh BARAL
3. F/O. Bhogendra KATHAYAT
4. Mr. Mukesh DANGOL, ATC Officer, MoCTCA

Note:

1. This report contains the facts which have been determined up to the date of publication. This information is published to inform the aviation industry and the public of the general circumstances of accidents and serious accidents.

2. The extracts may be published without specific permission provided that the source is duly acknowledged, the material is reproduced accurately and it is not used in a derogatory manner or in a misleading context.

Acknowledgements:

The Commission would like to thank to the Government of Nepal, TSB Canada, AAIB (UK), Honeywell Inc. (USA) and all those who spared out their valuable time and suggestionsin course of investigation to prepare this report.

Abbreviations and Definitions

AD	Airworthiness Directives
ADAHRS	Air Data Attitude Heading Reference System
AFT	Rear (Antonym of Forward)
AGL	Above Ground Level
AIG	Aircraft Accident and Incident Investigation
ALAR	Approach and Landing Accident Reduction
AMSL	Above Mean Sea Level
AMT	Aircraft Maintenance Technician
ARP	Aerodrome Reference Point
ATF	Aviation Turbine Fuel
ATC	Air Traffic Controller
ATPL	Airline Transport Pilot License
ATZ	Aerodrome Traffic Zone
AUW	All up weight
BR	Mist
B. S.	Bikram Sambat
C of A	Certificate of Airworthiness
CAAN	Civil Aviation Authority of Nepal
CFIT	Controlled Flight Into Terrain
CG	Center of Gravity
CPL	Commercial Pilot License
CRS	Certificate of Release to Service
CTR	Control Zone
CVR	Cockpit Voice Recorder
DCP	Designated Check Pilot
DD	Deferred Defect
DFDR	Digital Flight Data Recorder
DI	Daily Inspection
EGPWS	Enhanced Ground Proximity Warning Systems
ELT	Emergency Locator Transmitter
F/O	First Officer
FAA	Federal Aviation Administration
FDR	Flight Data Recorder
FG	Fog
FMS	Flight Management System
FOM	Flight Operations Manual
FOR	Flight Operation Requirements
Ft/min	Feet per Minute
FWD	Forward
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
HF	High Frequency

HFACS	Human Factor Analysis and Classification System
HSI	Horizontal Situation Indication
IFR	Instrument Flight Rules
INMCC	Indian Mission Control Center
IP	Instructor Pilot
Kg	Kilogram
KHz	Kilo Hertz
Kts	Knots
Lbs	Pounds
LCD	Liquid Crystal Display
LH	Left Hand
LRU	Line Replaceable Unit
LST	Local Standard Time
MAU	Modular Avionics Unit
MEL	Minimum Equipment List
METAR	Meteorological Report
MHz	Mega Hertz
MoCTCA	Ministry of Culture, Tourism and Civil Aviation
MSA	Minimum Safe Altitude
Mtrs	Meters
N/A	Not Applicable
NSC	No Significant Cloud
NM	Nautical Mile
NTSB	National Transportation Safety Board
OAT	Outside Air Temperature
OM	Operations Manual
Pax	Passengers
PF	Pre-Flight
PFD	Primary Flight Display
PI	Preflight Inspection
PIC	Pilot in Command
POH	Pilot's Operating Handbook
PPC	Pilot Proficiency Check
QNH	Pressure Setting to Indicate Elevation AMSL
RH	Right Hand
RTOW	Regulated Take-Off Weight
SB	Service Bulletin
SOP	Standard Operating Procedure
TAWS	Terrain Awareness and Warning Systems
TSB Canada	Transportation Safety Board of Canada
UTC	Universal Co-ordinated Time
VFR	Visual Flight Rules
VHF	Very High Frequency
WX	Weather

Definitions

Crew Decision Making: Decision making is the cognitive process of selecting a course of action from among multiple alternatives. The decision-making process produces a choice of action or an opinion that determines the decision maker's behavior and therefore has a profound influence on task performance.

Crew Resource Management: Crew resource management or cockpit resource management (CRM) is a set of training procedures for use in environments where human error can have devastating effects. Used primarily for improving air safety, CRM focuses on interpersonal communication, leadership, and decision making in the cockpit.

Human Factors : Human factors is the discipline concerned with optimizing the relationships between people and their activities through the systematic application of the human sciences, integrated within the framework of system engineering.

Over Confidence: The overconfidence effect is a well-established bias in which a person's subjective confidence in his or her judgments is reliably greater than the objective accuracy of those judgments, especially when confidence is relatively high.

Situational Awareness: Situational Awareness (S.A.) means having a mental picture of the existing inter-relationship of location, flight conditions, configuration and energy state of your aircraft as well as any other factors that could be about to affect its safety such as proximate terrain, obstructions, airspace reservations and weather systems.

Skill-Based Behaviors: Behaviors that rely on stored routines or motor programs that has been learned and can be repeated without conscious thought.

Spatial Disorientation: Spatial disorientation, spatial unawareness is the inability of a person to correctly determine his/her body position in space. When a pilot does not know in flight where his or her body is in relation to the surface of the Earth, the pilot has spatial disorientation (S.D.)

Violation:A Violationis an intentional action (or inaction) that results in noncompliance with known rules, policies, procedures or acceptable norms

SYNOPSIS

On 24 February 2016 at 02:05, a Viking DHC-6/400 aircraft with registration number 9N-AHH, operated by Tara Air Pvt. Ltd departed from runway 22 at Pokhara airport of western Nepal as a scheduled domestic flight to Jomsom airport. The aircraft was cleared for Jomsom by Pokhara Tower under VFR operation to be flown at10500ft via direct track. The aircraft met a CFIT accident at Solighopte, Dana VDC, Myagdi district of Nepal.

On reaching around 5 miles before GHOREPANI passing 10,100 ft, the Captain told that cloud cells were still present so advised F/O to continue climb to 12,000 ft and also informed that they will take a chance till TATOPANI and decide whether to continue or divert. At 02:14:50 while over GHOREPANI area at 11,500 ft the EGPWS TERRAIN alert and at 02:14:52 PULL UP warning came while they were not visual and at 02:15:01 it was stated that they were visual after the warning stopped at 02:14:53. At 02:15:27 the captain instructed F/O to maintain heading of 330 and flight level just below the cloud, after which a shallow descent was initiated. At this time Captain asked F/O whether his side was visual, in response F/O said somewhat visual. The Captain then instructed F/O to descent to 10,000 ft. Once the descent was started at 02:15:55 passing 11,000 ft an OVERSPEED warning sounded in the cockpit for 2 seconds as the speed reached 152 knots.

At 02:17:58 EGPWS TERRAIN alert sounded when the aircraft was at 10,200 ft and descending on heading 321 with right bank angle of around 3 degrees. At 02:18:06 when the aircraft had descended to 10,100 ft the PULL UP WARNING sounded for which the Captainresponded not to worry about and at 02:18:12; when the aircraft was at 10,000 ft the Captain took-over the control, continued descent and asked F/O whether his side was visual.At 02:18:44 when aircraft reached 10150 ftPIC told “what I will do is now I will turn to heading of LETTE” (another way point on route to Jomsom); while the PULL-UP warning was continuously sounding. At 02:18:49 when the aircraft was at 10300 ft right bank angle increased up to 16 degrees with pitch up attitude of 7 degree. At 02:18:52 the Captain told that he would start climb when the aircraft had reached 10,350 ft; pitch attitude of 10 degrees and still on right bank. The aircraft reached zero bank at 02:18:53 and started shallow left bank with pitch attitude of 12 degrees nose up. By 02:18:57 the bank angle reached 20 degrees left with pitch attitude of 11.8 and altitude of 10,550 ft.

As shown by FDR Data, at 02:19:03when the aircraft was in a left bank of 25^0, with 7^0 pitch up on 335^0 heading while EGPWS “Terrain Terrain – warning” the rear belly part initially hit the ground at an altitude of 10,700 ft (as per FDR) and the aircraft destroyed by the CFIT impact and rested at an altitude of 10982 ft (as per GPS data), at N$28^0$34.553’ E083^0 36.916’, which is 77 meter away from the first point of impact.

After receiving information of communication loss with the aircraft, RCC was activated at 08:30 LT well before the crash site being spotted by the villagers at 13:25 LT. To intensify the search and rescue mission, despite cloudy weather, army and civilian helicopters were sent immediately from Pokhara and Jomsom to the potential crash site carrying necessary equipment and technical teams.

All 23 persons onboard; 3 crew and 20 passengers including 2 infants lost their lives in this accident. The aircraft was completely destroyed due to the nature of impact and post-crash fire. There was no fatality on ground.

The accident was notified to ICAO, FAA/ NTSB USA, TSB Canada, and AAIB UK by the Aircraft Accident Investigation Commission and CAAN immediately after the accident.

Pursuant to Civil Aviation (Accident Investigation) rules 2071 B.S., the Government of Nepal constituted a five member Accident Investigation Commission on 25th February 2016 to investigate the fatal accident. The Investigation Commission was mandated to determine the facts, conditions and circumstances pertaining to the accident and make necessary recommendations to preclude a recurrence and enhance aviation safety in future. The Commission commenced its investigation task formally on 26 February 2016.

The Commission concludes that the probable cause of thisaccident was the fact that despite of unfavourable weather conditions, the crew's repeated decision to enter into cloud during VFR flight and their deviation from the normal track due to loss of situational awareness aggravated by spatial disorientation leading to CFIT accident.

The Commission has made 24 (twenty-four) safety recommendations including 1 (one) interim safety recommendation already issued on 2nd April 2016 to the concerned agencies for the further enhancement of aviation safety and to prevent such accidents in future.

This report is submitted to the Government of Nepal, Ministry of Culture, Tourism and Civil Aviation on 31st July 2016 (16 Shrawan 2073 B.S.)

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Figure 1: Tara Air before departure from Pokhara

Figure 2: Crash Location of 9N-AHH (Myagdi District, Nepal)

1 FACTUAL INFORMATION

1.1 History of the Flight

1.1.1 Prior History

The previous flight of the aircraft was on 23rd February 2016, a day before the accident, for Pokhara-Jomsom-Pokhara sector with the same set of crew. No failures were recorded or reported regarding the aircraft and its system including navigation systems. The CVR/FDR readout of the previous day flight revealed the following:

- Although Pokhara airport was opened for Departure ONLY and Bhairawaha airport was closed due to weather, the aircraft departed for Jomson.
- The aircraft flew in IMC condition until Ghorepani after which VMC weather prevailed and the crew were able to maintain visual through-out the rest of the flight.
- The EGPWS caution and warning were activated several times during the flight.
- During return flight from Jomsom to Pokhara, they were able to maintain VMC until Ghorepani after which, they had descended in an IMC until 7,800 ft.

After completion of the previous day's flight, they had a rest period of over 18 hours with an overnight stay in the crew-camp. So, the crew had sufficient rest time and the aircraft had no recorded problem for the flight.

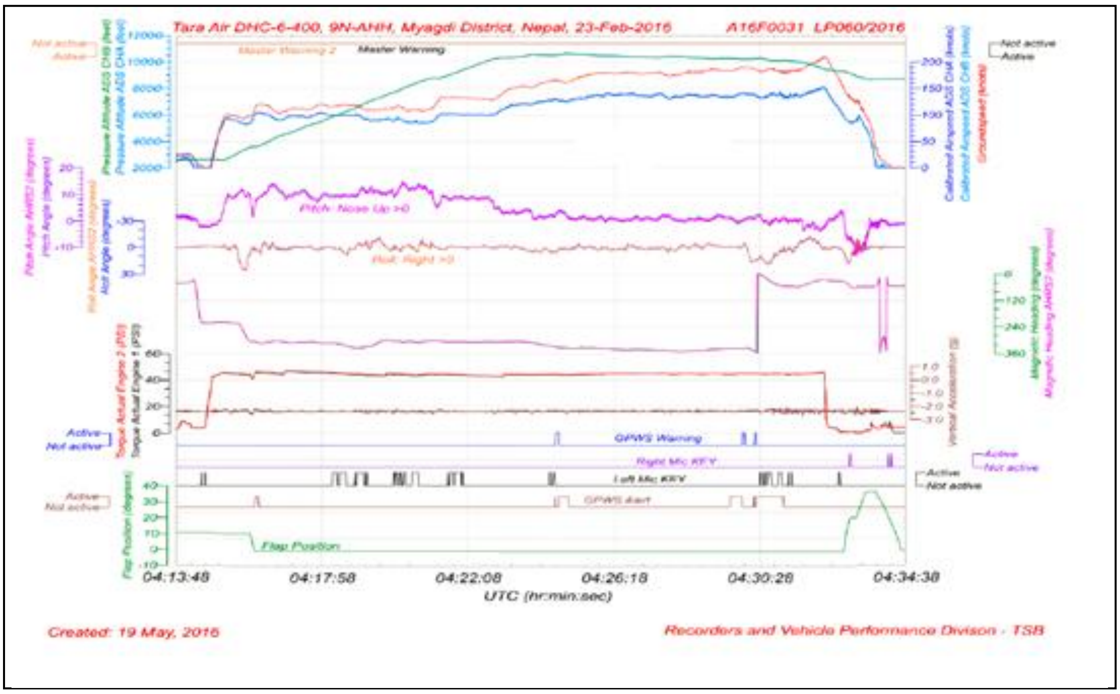


Figure 3: FDR plot of previous day flight

Additionally, CVR had retained recordings of JOM-PKR flight done by another set of crew on 22nd Feb 2016. No evidence of system malfunctions were recorded but there were several occasions of EGPWS Caution & Warning activatation.

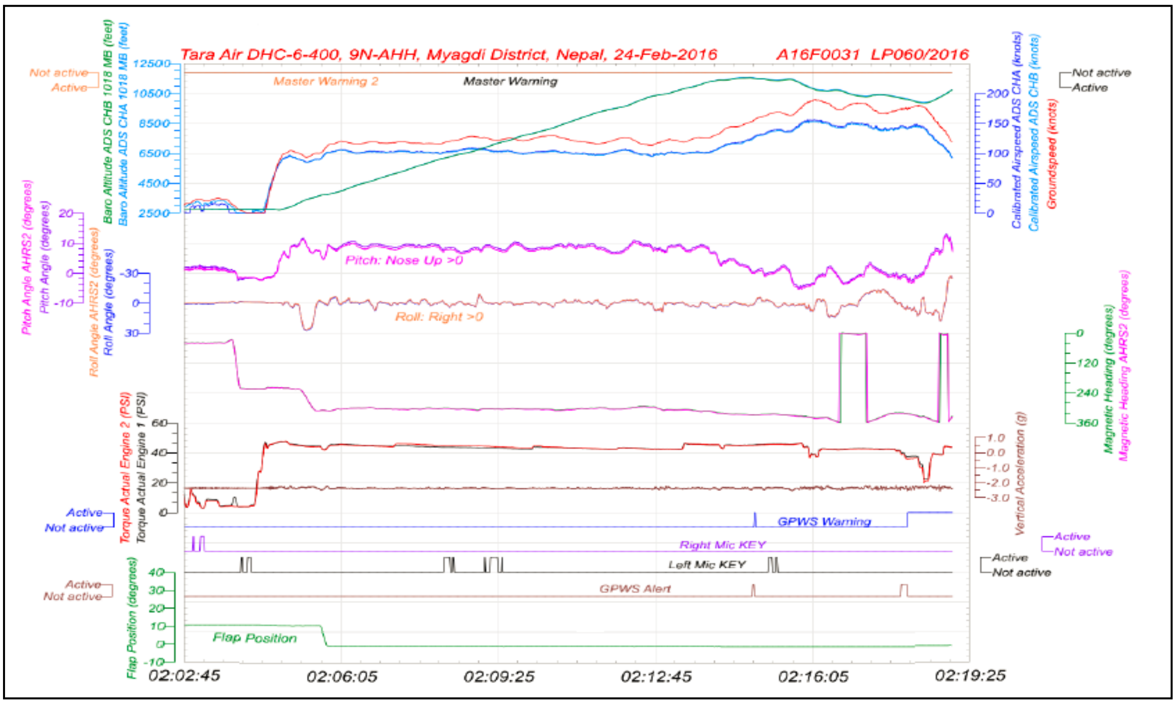


Figure 4: FDR plot of accident day

1.1.2 History of the flight

As per the flight plan submitted on 23rd February 2016, the aircraft was scheduled for VFR flight to Jomsom (VNJS) on 24th February with estimated off-block time of 01:00[1], intended cruising speed of 150 knots, intended level of 10,500 ft and via direct track. The first and second alternate aerodromes were Bhairahawa (VNBW) and Pokhara (VNPK) respectively and estimated elapsed time was 20 minutes with the fuel endurance of 2 hours and 30 minute. Based on the information from the CVR, FDR and ATC records, the following description of the history of the flight was reconstructed:

At 01:55, the first-officer contacted Pokhara tower requesting Jomsom and Bhairahawa weather. Upon receiving Jomsom weather which was 8 km visibility towards Lete (arrival track) and foothill partially visible; at 01:56 F/O requested start-up for Jomsom. First-officer then briefed the weather to the captain, in response to this the captain responded by saying ‘Let’s have a look, if not possible we will return’ (Translated from Nepali conversation). While performing the ‘before start checklist’, they received weather of Bhairahawa as closed. After completing the checklist and start-up the first-officer at 02:00 requested taxi-clearance.

[1]*Unless otherwise specified, all times are UTC times.*

The ATC informed runway change to 22 instead of runway 04 and gave taxi clearance. At 02:03 while taxiing the captain considering bad weather condition expressed his concern over the runway change with F/O but failed to express it to the ATC. As briefed by captain earlier, the control was transferred to F/O and at 02:04 F/O made a normal take-off.

At 02:08 the captain reported 5 miles at 6,200 ft to ATC. At 02:09, while passing through 7,000 ft the captain informed the actual weather, which was light haze, mountain not visible but had ground contact, to an ultra-light aircraft upon his request. As per the cockpit conversation, the crew were comparing the base of the cloud which was higher than the day before and proposed to continue climb to 12,500 ft if not on-top of the cloud at 10,500 ft. Around 5 miles before Ghorepani passing 10,100 ft, the captain told that cells were still present so advised F/O to continue climb to 12,000 ft and told that they will proceed till TATOPANI and decide to continue or divert. At 02:14 approaching GHOREPANI and passing 11,400 ft, Captain told F/O to maintain level to be in between the cloud layers and briefed F/O that if they had to divert it would be a left turn. At the same time captain asked repeatedly to F/O if his side was raining for which F/O told and confirmed not visual, after which captain told they would see and decide (regarding continuation of flight).

At 02:14:50 while over Ghorepani area at 11,500 ft the EGPWS TERRAIN alert and at 02:14:52 PULL UP warning came while they were not visual and at 02:15:01 it was stated that they were visual and by 02:14:53 the warning stopped. At 02:15 while maintaining 11,500 ft the captain reported ATC that they are at Ghorepani at level 10,500 ft after which frequency changeover to Jomsom tower was given. At 02:15:27 the captain instructed F/O to maintain heading of 330^0 and flight level just below the cloud, after which a shallow descent was initiated. At this time captain asked F/O if his side was visual, in response F/O replied somewhat visual. The Captain then instructed F/O to descent to 10,000 ft. Once the descent was started at 02:15:55 passing 11,000 ft an OVERSPEED warning sounded in the cockpit for 2 seconds as the speed reached 152 knots.

At 02:16 while passing 10,700 ft captain advised F/O to make a left turn so that it would be easy to turn if required as he was able to see his side. Then F/O asked if left side was visual for which the captain informed that not that side (towards the track) but somewhat visual to the left of him and told that the TRACK TO GO was TO THE LEFT whereas they were actually left of the track and had descended to 10,300 ft.

At 02:17:58 EGPWS TERRAIN alert sounded when the aircraft was at 10,200 ft and descending on heading of 321^0 with right bank angle of around 3^0. At 02:18:06 when the aircraft had descended to 10,100 ft the PULL UP WARNING sounded for which the captain said not to worry and at 02:18:12; when the aircraft was at 10,000 ft the captain took-over the control, continued descent and asked

F/O if his side was visual. The F/O informed that right side was not visual at all by which the aircraft had continued shallow descent on heading 325^0 with right bank angle reaching up to 13^0 at 2:18:19 and by 02:18:23 the aircraft once again returned back to 0^0 bank angle. At 02:18:23 the captain started left bank followed by right bank again while still on a shallow descent until 02:18:27.Upon reaching 9,850 ft (lowest altitude) the aircraft started very shallow climb. At 02:18:35 when aircraft was 9,920 ft the captain told F/O that they reached Landslide (a checkpoint which is on track to Jomsom on the right side of the Kali-Gandaki River).

At 02:18:44 when aircraft reached 10,150 ft captain told “what I will do is now I will turn to heading of LETTE” (another way point on route to Jomsom); while the PULL-UP warning was continuously sounding. At 02:18:49 when the aircraft was at 10,300 ft right bank angle increased up to 16^0 with pitch up attitude of 7^0. At 02:18:52 the captain told that he would start climb when the aircraft had reached 10,350 ft; pitch attitude of 10^0 and still on right bank. The aircraft reached zero degree bank at 02:18:53 and started shallow left bank with pitch attitude of 12^0 nose up. By 02:18:57 the bank angle reached 20^0 left with pitch attitude of 11.8 and altitude of 10,550 ft and captain was still questioning F/O about the visibility towards his side but F/O informed his side not visible completely.

The last data recorded in FDR was at 02:19:03 when the altitude had reached around 10,700 ft; pitch attitude of 7^0 nose up and left bank angle of 25^0 heading of 335^0 with EGPWS PULL-UP warning ON.

1.2 Injuries to Persons

Among 23 passengers onboard, all were Nepalese citizen except one Chinese and another Kuwaiti Citizen (Table 1).

Table 1: Injuries to Persons

Injuries	Crew	Passenger		Total
		Adult	Infant	
Fatal	**03**	**18**	**02**	**23**
Serious	**-**	**-**	**-**	**-**
Minor	**-**	**-**	**-**	**-**
None	**-**	**-**	**-**	**-**
Total	**03**	**18**	**02**	**23**

1.3 Damage to Aircraft

Aircraft was completely destroyed due to the impact and post impact fire (Refer Appendix-A). The aircraft’s main structure like wings and tail portion were severely damaged. Most of the fuselage structure was consumed by the post impact fire.

RH Engine and its accessories were found in burnt condition, RH propeller was detached from the engine and blades were scattered at various locations near the point of first impact as shown in Appendix – B. LH engine and propeller were found unburnt in main wreckage area with twisted blades.

The fin and tail portion of the aircraft were lying around 300 meters downhill from the first impact point. The main landing gears were detached from the fuselage and left landing gear was found 150 meters ahead downhill from the main wreckage position, right landing gear and nose wheel were located below the first point of impact as shown in Appendix - B. FDR, CVR and ELT were located intact at their installed position along with a section of empennage which was approximately 1000 m downhill from the crash site.

1.4 Other Damages

The crash site was very remotely located and not easily accessible due to the sloppy and rocky terrain. No damage was caused to private property or persons on ground. There was no noticeable environmental effect caused by the accident.

1.5 Personnel Information

1.5.1 Pilot-in Command (PIC)

Date of Birth	: 25 March 1962
Gender	: Male
Type of License and Issued by	: ATPL No. 134; CAA-N
License Validity	: 30 April 2016
Aircraft Rating	: DHC-6/300, SAAB340B, J-41, DHC-6/400
Instructor Ratings	: DHC-6/300; J-41; DHC-6/400.
Previous accident/incident	: Wing tip collision with Sita air at Simikot, on 21 February 2015
Medical Certificate Type and Validity	: Class I / 30 April 2016
Limitation/ Restriction	: Shall wear correcting lens and carry a spare set of spectacles while exercising privilege
Aviation Language Proficiency & validity	: Level 4 / 28 April 2017

In-service training/courses:

Emergency evacuation training on DHC-6/300	: 23 May 2014
Simulator Training	:13-15 June 2014
Dangerous Goods Regulation Training	: 26 August 2014
Route Check	: 27 October 2014
Pilot Proficiency with Instrument, IP/DCP Check	: 30 January 2015
Refresher ground training DHC-6/300	: 11-14 May 2015
PPC with DCP rating on DHC-6/300/400	: 26 May 2015
DHC-6/400 difference familiarization flight	: 23 July 2015

Crew Resource Management Training	: 26 August 2015
PPC with DCP rating on DHC-6/400	: 27 January 2016

Flight Experience:

Total hours flown	: 20108 Hours
Total hours on DHC type	: 18500 Hours
Total hours on type DHC-6/400	: 217 Hours
Flight hours in 12 months	: 460 Hours
Flight hours in 3 months	: 128 Hours
Flight hours in 30 days	: 47 Hours
Flight hours in 7 days	: 09 Hours

Captain along with his crew set arrived Pokhara base on 22nd February 2016 to replace another set of crew set. The captain was on 3rd day of 4 nights/5 days roster duty rotation for Pokhara base as per roster published by Tara Air's Operations Department. He was scheduled to return back to Kathmandu on 26 February 2016.

The Captain started his professional flying career in 1989 as a F/O of DHC-6/300 in the then Royal Nepal Airlines. He had 10 years of flying experience in DHC-6/300 before joining Yeti Airlines in the year 1999. While working for Yeti airlines he received type trainings on SAAB-340'B', Y12, BAE Jetstream J-41 and instructor ratings on J-41. After establishment of TARA Air in 2009 he continued his service in Tara air as instructor pilot in DHC-6/300. He was also DCP of the airline for the DHC-6/300 and DHC-6/400 aircrafts.

On 23 July 2015 he had undergone difference training and difference familiarization flight on DHC-6 series 400. He was also involved on ferry flight of the same aircraft initially having registration C-GUVT conveyed to Tara Air from Canada to Kathmandu. The aircraft landed on Tribhuvan International Airport on 26th of September 2015.He had accumulated 217:15 Hours on type DHC-6/400 including ferry flight. There were no such noticeable remarks in Captain's flight training records which could compromise flight safety.

1.5.2 Co-pilot

Date of Birth	: 13 December 1986
Gender	: Male
Type of License and Issued by	: CPL No 444; CAAN
License Validity	: 31 December 2016
Aircraft Rating	: DHC-6/300, DHC-6/400
Instrument Rating	: 30 June 2016
Previous accident/incident	: Nil
Medical Certificate Type and Validity	: Class I / 31 December 2016
Limitation/ Restriction	: Shall wear correcting lens and carry a spare set of spectacles while exercising privilege
Aviation Language Proficiency and validity	: Level 4 / 16 Feb 2017

In-service training/courses:

Dangerous Goods Regulation Training	: 2 September 2014
Refresher ground training DHC -6/300	: 11-14 May 2015
Crew Resource Management Training	: 7 September 2015
Pilot Proficiency with Instrument check	: 16 December2015
Simulator Training	: 21-23 December 2015
Emergency evacuation training (DHC-6/300)	: 19-21 May 2014
Route Check	: 6 December 2015
DHC-6/400 difference Training	: 4 January 2016
DHC-6/400 difference familiarization flight	: 4 January 2016

Flight Experience:

Total hours flown	: 760 Hours
Total Hours on DHC Type	: 560 Hours
Total hours on Type DHC -6/400	: 14 Hours
Flight hours in 12 months	: 347 Hours
Flight hours in 3 months	: 74 Hours

F/O along with his Captain arrived Pokhara base on 22nd February 2016 and schedule to return back to Kathmandu on 26th February 2016.

The F/O received CPL training in Cape Town, South Africa from 2007 to 2009. His DHC-6/300 initial type training was conducted from 04-23 December 2013 and the Checkride was completed on 27th December 2013 with recommendation of "additional circuit and landing need to be improved" by the DCP. The additional training was conducted on 10-11 February; followed by Checkride on 15 February 2014. His Nepalese CPL with DHC-6/300 type was issued on 9th July 2014. He was not employed by any airlines for almost five years before joining Tara Air in 2014. He received DHC-6/400 type license on 14th January 2016.

He had a total of 760 hours of flight experience including the 200 hours flight time acquired during his initial flight training in South Africa. After introduction of DHC-6/400 aircrafts in fleet of Tara Air he received differences training and familiarization flight in DHC-6/400 on 4th of Jan 2016. He had a total of 14:40 hours flight experience on the DHC-6/400 type.

1.5.3 Cabin Crew

Date of Birth	: October 26, 1990
Gender	: Female
Cabin Crew Certificate Number & Issued by	: 1051; CAA-N
Cabin Crew Certificate issuance date	: December 23, 2014.
Cabin Crew Certificate valid till	: December 2017.
Aircraft Rating	: DHC-6/300, DO-228.
Medical valid till	: July 2016

In-service training/courses:

Basic training	: August 2012
Dangerous Goods Regulation Training valid till	: September 2016
Recurrent training valid till	: June 2016
Crew Resource Management Training valid till	: September 2016
Emergency Evacuation Drill valid till	: June 2016
First Aid valid till	: June 2016
Fire Fighting valid till	: June 2016

1.5.4 Air Traffic Control Personnel

Three air traffic controllers were on duty in Pokhara Air Traffic Control tower at the time of the accident. One of the ATC was working in capacity of active controller and the other as coordinator. They possessed experience of 8 months after basic training on ATC licensing, Aerodrome control and AFIS (AAA). They were authorized to provide Air Traffic Control Service under supervision of Rated controller. Both of the controllers were being supervised by experienced Air traffic controller who was in the service since last 18 years. Likewise; in Jomsom a well experienced AFIS personnel was providing AFIS service at the time of occurrence.

1.6 Aircraft Information

1.6.1 General

The Viking Twin-Otter DHC-6/400 is a twin-engine, turbo-prop, non-pressurized, non-retractable landing gear airplane certified for day/night flight in VFR and IFR conditions. The structure is an all-metal, high-wing monoplane with a tailplane. The aircraft is equipped with two 620SHP Pratt & Whitney PT6A-34 turbine engines with 3-bladed Hartzell HC-B3TN-3D Propellers. The standard fuselage fuel tanks (FWD and AFT tanks with 4 cells each) installed under the cabin floor have tank capacity of total 2576 pounds Jet A1 and 99% of the fuel is available in flight. The DHC-6 /400 avionics suite is developed around a four-screen Honeywell Primus Apex Electronic Flight Instrument System (EFIS). The suite fully integrates primary flight display, communication, navigation, engine instrument displays, electrical and other systems displays, and crew alerting system (CAS) messages through Apex. Apex, federated equipment items and safety systems including but not restricted to electronic checklists, electronic charts, TCAS I, EGPWS (TAWS), flight data recorder, cockpit voice recorder and Emergency Locator Transmitter (ELT) systems are also integrated in it. An Electronic Standby Instrument System (ESIS) is provided through the L3 Communication GH-3100 ESIS that includes a remote three-axis magnetometer and an independent standby emergency battery.

The aircraft with serial number 926 manufactured by Viking Aircraft Limited in 13 August 2015 was delivered to Tara Air and registered as 9N-AHH.

Figure 5: Cockpit View

1.6.2 Aircraft

Model	-	DHC-6/400
Type Certificate Number	-	A-82(Canada)
Manufacturer	-	Viking Air Limited, Canada
Classification Aircraft Category	-	Transport (Passenger)
Registration	-	9N-AHH
Operator	-	Tara Air Pvt.Ltd, Kathmandu.
Owner	-	Aerostar Alpha Ltd, British Virgin Island

(The aircraft owner had signed aircraft operating lease with purchase option agreement for one DHC-6/400 aircraft MSN 926 dated 10th August 2015 with Tara Air Pvt. Ltd.)

Serial No	-	926
Date of Manufacture	-	26th June 2015
Validity of C of A	-	7 October 2016
Maximum Take-off Mass	-	12,500 lb (5,670 kg)
Maximum Landing Mass	-	12,300 lb (5,579 kg)
Total Airframe Hours (TTSN)	-	270:19
Total Number of Landings (TCSN)	-	482

1.6.3 Engine

Manufacturer	-	Pratt & Whitney Canada	
Type	-	PT6A-34	
Type Certificate Number	-	E-6 (Canada)	
Engine position	-	LH	RH
Serial No	-	PCE-RB0889	PCE-RB0890

Installed Date	-	26th June 2015	26th June 2015
Total Time Since New (TTSN)	-	270:19	270:19
Total Cycle Since New (TCSN)	-	482	482
Last Repair / Overhaul Done	-	N/A	N/A

1.6.4 Propeller

Manufacturer	-	Hartzell Propeller Inc.	
Type	-	HC-B3T	
Type Certificate Number	-	P-49(USA)	
Propeller position	-	LH	RH
Serial No	-	BUA33276	BUA33309
Installed Date	-	26th June 2015	26th June 2015
Total Time Since New (TTSN)	-	270:19	270:19
Total Cycle Since New (TCSN)	-	482	482
Time since Overhaul	-	N/A	N/A

1.6.5 Aircraft Maintenance History

As per technical records, all scheduled maintenance were accomplished. Flight test of the aircraft was conducted in Kathmandu on 6th October 2015 and Certificate of Airworthiness (C of A) was issued on 8th October 2015. Latest 125 hrs inspection (check no. 3) was carried out and Certificate of Release to Service (CRS) was issued on 21st Feb 2016. CRS was valid till TSN 394:00 Hrs or 20th April 2016 whichever is the sooner. Terrain database was up-to-date and valid till 24th February 2016. PRIMUS EPIC INAV/NAV database was up-to-date and valid till 2nd March 2016. Daily inspection (DI) and Preflight inspection (PI) were completed on 23rd Feb 2016. No mandatory Airworthiness Directives (ADs), Service Bulletins (SBs) and Modifications (Mods) were due. There were no reported defects, Deferred Defect (DD) and pending MEL items.

The aircraft was maintained by Yeti Airlines, a CAAN 145 AMO, as per the aircraft maintenance agreement between Tara Air Pvt. Ltd. and Yeti Airlines Domestic Pvt. Ltd.

1.6.6 Performance Data

The engineering data from the DFDR were examined and analyzed together with the data of the aircraft given by aircraft manufacturer along with the mechanical behavior of the aircraft. This engineering analysis provided the following findings:

- The good match between the DFDR recordings and behavior of the aircraft confirms that the aircraft behaved in accordance with the design specifications.
- No indications could be found that extraordinary forces acted on the aircraft prior to impact or that any structural part of the aircraft had been substantially deformed or damaged prior to the accident.
- Throughout the accident flight, the aircraft reacted normally to changes in engine power and deflections of the control surfaces.
- There is nothing to indicate effects of ice formation on the aircraft.

Further, performance charts and data were analyzed for the aircraft take-off, cruise and other related performance factors. The performance analysis provided the following findings:

- Although Tara Air is using the CAAN approved RTOW performance data, the basis of calculation of RTOW of DHC-6/400 by Tara Air could not be established, due to the following factors:
    - Tara Air SOP of DHC-6 of Tara Air on chapter -7.1 CAAN Policy states "all Maximum take-off and landing weights are calculated based on 70% of the runway length being available for the ground run, using the graph for the DHC-6 twin otter 400 series, contained in the sales engineering report ser-6-228".
    - Tara Air Operations Manual Part B weight and balance chapter-12 STOL Operations- DHC-6 300/400 Twin –Otter also states "all Maximum take-off and landing weights are calculated based on 70% of the runway length being available for the ground run, using the graph for the DHC-6 twin otter 300/400 series, contained in the sales engineering report ser-6-228".
    - When consulted with Viking, they advised that the weight should be calculated using the DHC-6/400 AFM and, if approved by local authority using the MPS.
    - Letter dated 1/3/2073 B.S. signed by accountable manager (CEO) of Tara Air states "as DHC-6/300 and DHC-6/400 are of same type and identical, the basis of calculation of RTOW of DHC-6/300 are also applicable for the DHC-6/400."

1.6.7 Flight and Navigation Instruments

The aircraft was fitted with the Honeywell Primus Apex Avionics System. The major subsystem include Electronic Display System (EDS), Crew Alerting System (CAS), Flight Management System (FMS), Global Positioning System (GPS), Traffic Alert and Collision Avoidance System (TCAS), Terrain Alert and Collision Avoidance System (TAWS), Weather Radar System (WX), Air Data Attitude Heading Reference System (ADAHRS), Radio Altimeter System and Aircraft Diagnostic and Maintenance System (ADMS). The Modular Avionics Unit (MAU) is the primary component of the integrated system.

- The Electronic Display System (EDS) consists of four identical 10" wide LCD panel Display Units (DUs).
- Crew Alerting System (CAS) gives both visual and aural notification to advise the flight crew of malfunctions, abnormalities, or system status.
- Flight Management System (FMS) is an area navigation computer. The FMS has the capability to calculate and present both lateral and vertical navigation guidance.
- GPS are separate LRUs and transmit current positional data to the MAU.
- TCAS uses the transponder reply data, air data, and heading data to generate graphical representations of surrounding aircraft traffic information.

- Terrain Awareness and Warning System (TAWS) is a class A TAWS (also known as the MK VI enhanced ground proximity warning system -- EGPWS) that uses altitude, air data, position derived from the FMS, and a built-in terrain and obstacle database to display when nearby terrain becomes a potential threat. TAWS provide terrain avoidance display colored to alert or warn the pilot as to the elevation of surrounding terrain.

Figure 6: EGPWS

The terrain data from the TAWS is displayed on PFD. The terrain display and WX overlay selections are mutually exclusive. When the terrain display is present, the weather radar display is removed. The terrain overlay is implemented with auto pop--up on both PFD HSIs when a terrain alert condition (terrain caution or warning) is detected, replacing the weather overlay display, if weather display is active.

The TAWS contains a database that includes topographical data of various regions of the world. The resolution of the database values varies with location and relative proximity to airports. The TAWS uses the topographical data and inputs from the GPS, FMS, ADAHRS, and radar altimeter to perform proximity computations. Terrain is shown in blends of the colors green, yellow, and red, depending on the above ground level (AGL) elevation of the aircraft relative to the surrounding terrain.

Figure 7: Primary Flight Display (PFD)

The MK VI EGPWS incorporates the functions of a legacy ground proximity warning system (GPWS) plus advanced features. Legacy GPWS includes the following alerting modes:

- Mode 1 -- Excessive descent
- Mode 2 -- Excessive terrain closure rate
- Mode 3 -- Altitude loss after takeoff
- Mode 4 -- Unsafe terrain clearance
- Mode 5 -- Excessive deviation below glide slope
- Mode 6 -- Advisory callouts.

In addition to these six basic functions, the MK VI EGPWS compares the aircraft position to an internal database and provides additional alerting and display capabilities for enhanced situational awareness and safety (hence the term Enhanced GPWS). The TAWS internal database consists of four subsets:

1. Terrain data.

2. Cataloged obstacles 100 feet or greater in height located within North America, portions of Europe, and portions of Asia (expanding as data is obtained).

3. Airport runway data containing information on all runways 2,000 feet or longer.

4. An envelope modulation database to support the envelope modulation features are described in Appendix F.

1.6.8 Aircraft Weight and Balance

Following are the weight and balance limitation as per the POH of Viking DHC-6/400 and the actual loading as per the load/trim sheet of the aircraft:

MTOW:	12,500 lbs	Actual Take-off Weight:	12,488 lbs
MLW:	12,300 lbs	Estimated Landing Weight:	12,288 lbs
CG MAC:	20%-25% to 36%	Actual Tahe-off CG MAC:	29.01%

The loads, CG and other mass balance values were found to be within permitted limits. Aircraft weight and balance report was amended on 1st October 2015 after installing O2 Bottle and Crash Axe:

Total Weight:	7488.7 lbs
Total Arm:	214.29 inch
Total Moment:	1604814.6 inch lbs

1.6.9 Crew Oxygen

A 22 cubic feet, 1800psi portable Oxygen Cylinder (Zodiac AVOX P/N: 25200-22, S/N: P13040360) that meets FAA Part 23.1443 requirements of constant flow Oxygen was installed in the cockpit on 1st October 2015. As per CVR records usage of oxygen was not established.

1.6.10 Meteorological Information

Meteorological observation station at Pokhara airport provides hourly METAR from 0015 to 1845 and SPECIES as required. There are fundamental meteorological equipments like surface wind sensors, temperature and Pressure sensor located 30m away from centerline of runway. Additionally, automatic sensors located on the rooftop of Pokhara tower that provides wind speed, wind direction, temperature and QNH.

1.6.11 Weather Conditions over Western Nepal

The Report prepared by Meteorological Forecasting Division, DHM, regarding prevailing weather conditions over Western Nepal is as follows:

Wind: Surface weather charts show that over western Nepal Northerly wind prevailed over-night on the 23rd of February at the surface and shifted to Southerly wind between 0000 and 0300 of 24th February.

Cloud: On the morning of 24th February, partly cloudy condition prevailed over most part of Western Nepal but generally cloudy condition existed over mid-western hills and mountains including Pokhara-Jomsom route with the predominance of low level clouds. Cloud cover increased progressively as the morning went on. The infrared imageries depicting the prevailing weather conditions before and after the accident are given below.

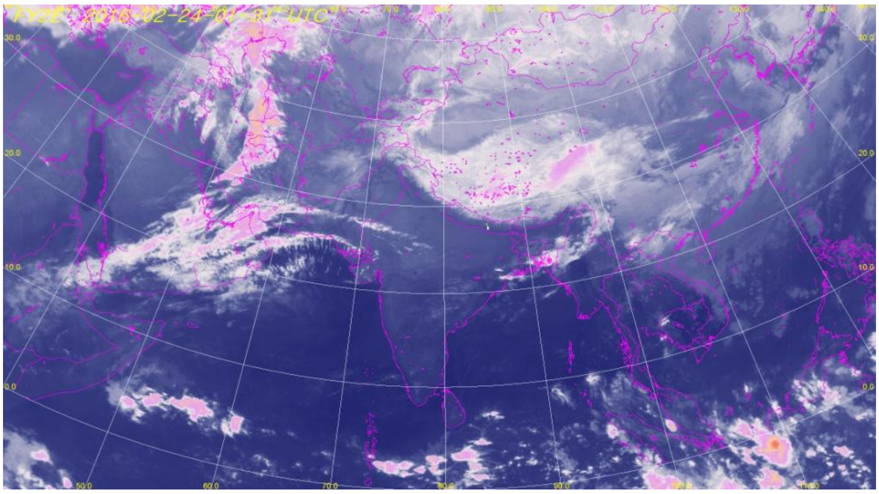


Figure 8: FY2E Infrared Image of 24th Feb at 0131 UTC (before the accident)

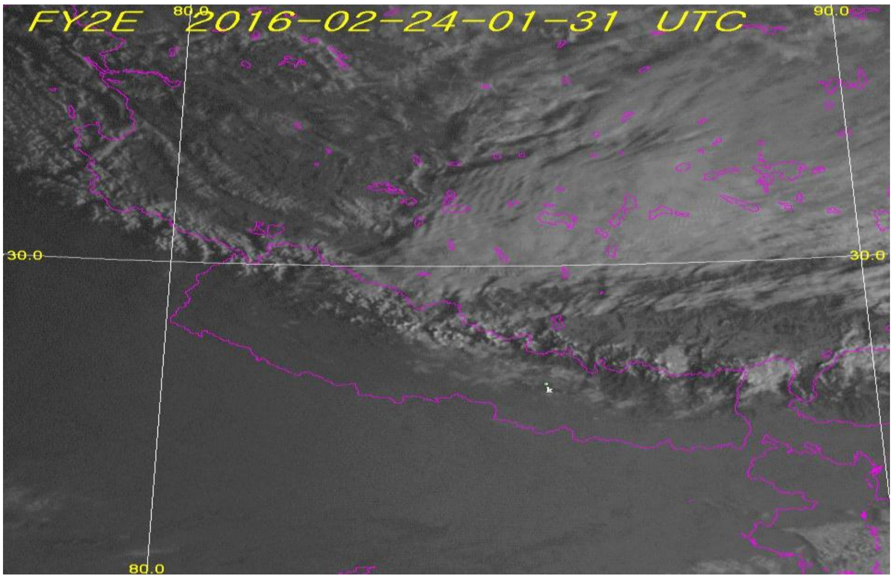


Figure 9: FY2E Visible Image (Zoomed/Cropped) of 24th Feb at 0131 (before the accident)

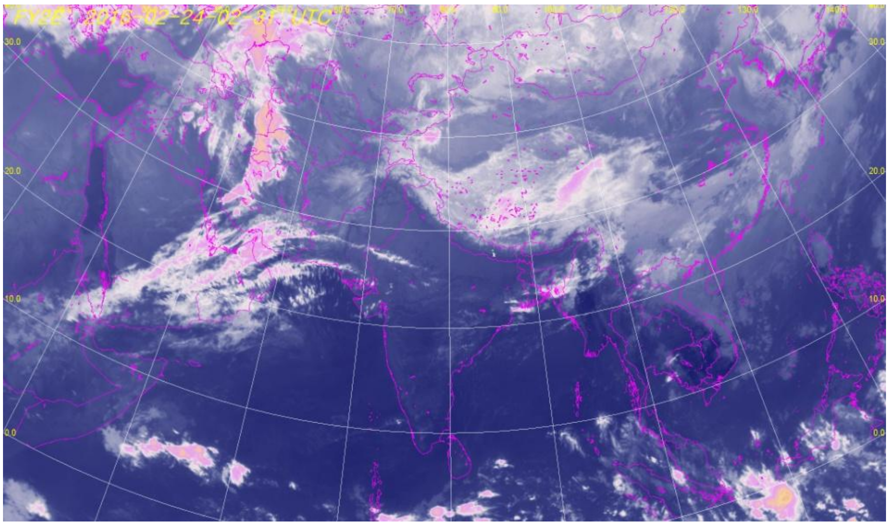


Figure 10: FY2E Infrared Image of 24th Feb at 0231 (after the accident)

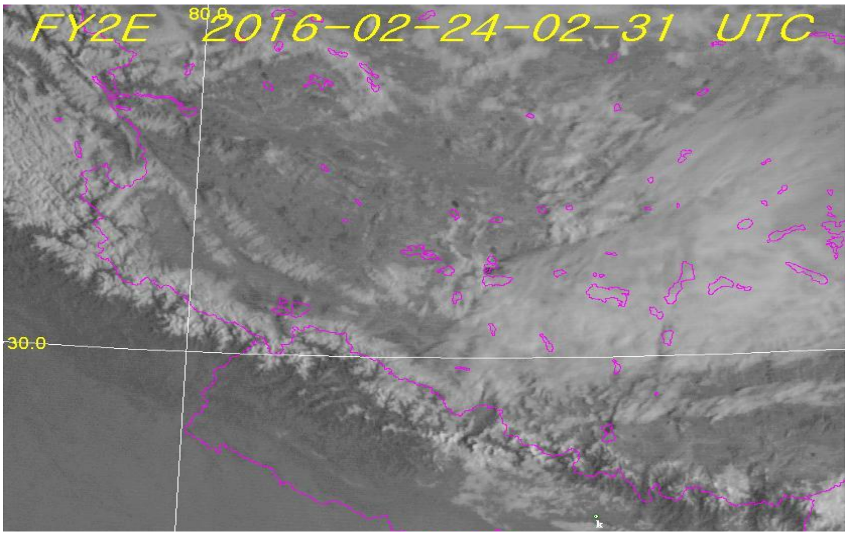


Figure 11: FY2E Visible Image (Zoomed/Cropped) of 24th Feb at 0231 (after the accident)

1.6.13 Weather at Departure Aerodrome

The weather at Pokhara airport on 24th February 2016 as supplied by Meteorological station in terms of METAR are as follows:

Table 2: METAR of 24th Feb 2016

Time (UTC)	Wind (KT)	Visibility(m)	Present Weather	Cloudiness		Temperature /Dew Point	QNH
0050	23004	4000	BR	FEW025 BKN080	SCT040	15/14	Q1017
0150	VRB02	4000	BR	FEW020 BKN070	SCT040	17/13	Q1018
0250	VRB02	4000	BR	FEW020 BKN070	SCT040	17/13	Q1018
0350	13004	4000	HZ	FEW020	SCT 040	19/13	Q1019

General weather pattern of Pokhara valley based on METAR could be summarized as below:

- The light wind conditions prevailed during the early morning with the wind direction varying from southeasterly to southwesterly.
- The METAR showed the visibility of 4000m till 0350z. During the early morning hour Mist (BR) was reported whereas haze (HZ) was stated at 0350z.
- Broken amount of cloud covered the sky during the early morning hours. There was a presence of altostratus cloud which implied the chances of precipitation.
- The surface temperature ranged from 15 to 17°C whereas the dew point remained constant from 0050z to 0350z. Presence of mist and the small difference between dew point and the air temperature signified the higher humidity (>70%).

1.6.14 Pokhara Tower Observation

ATC working at Pokhara tower observed the following weather conditions on 24th February.

Table 3: Weather Observation by Pokhara Tower

Time(UTC)	Wind	Visibility	Present	Cloudiness	Airport
0045	21004	3000m	BR	Sky Invisible	Airport closed
0155	24002	5km	HZ	Sky Invisible	VFR Normal
0312 (Rescue begins)		5 Km		Sky Invisible	
0410	09005	4000m	HZ	Sky Invisible	

Pokhara tower and Meteorological Office both used same visibility check point chart to determine visibility, however, a difference of 1000m in visibility was noted between the weather reported by Pokhara Met office and Tower. As per interviews with ATC officers, the aircraft was released on an overall visibility of 5000m at Pokhara airport.

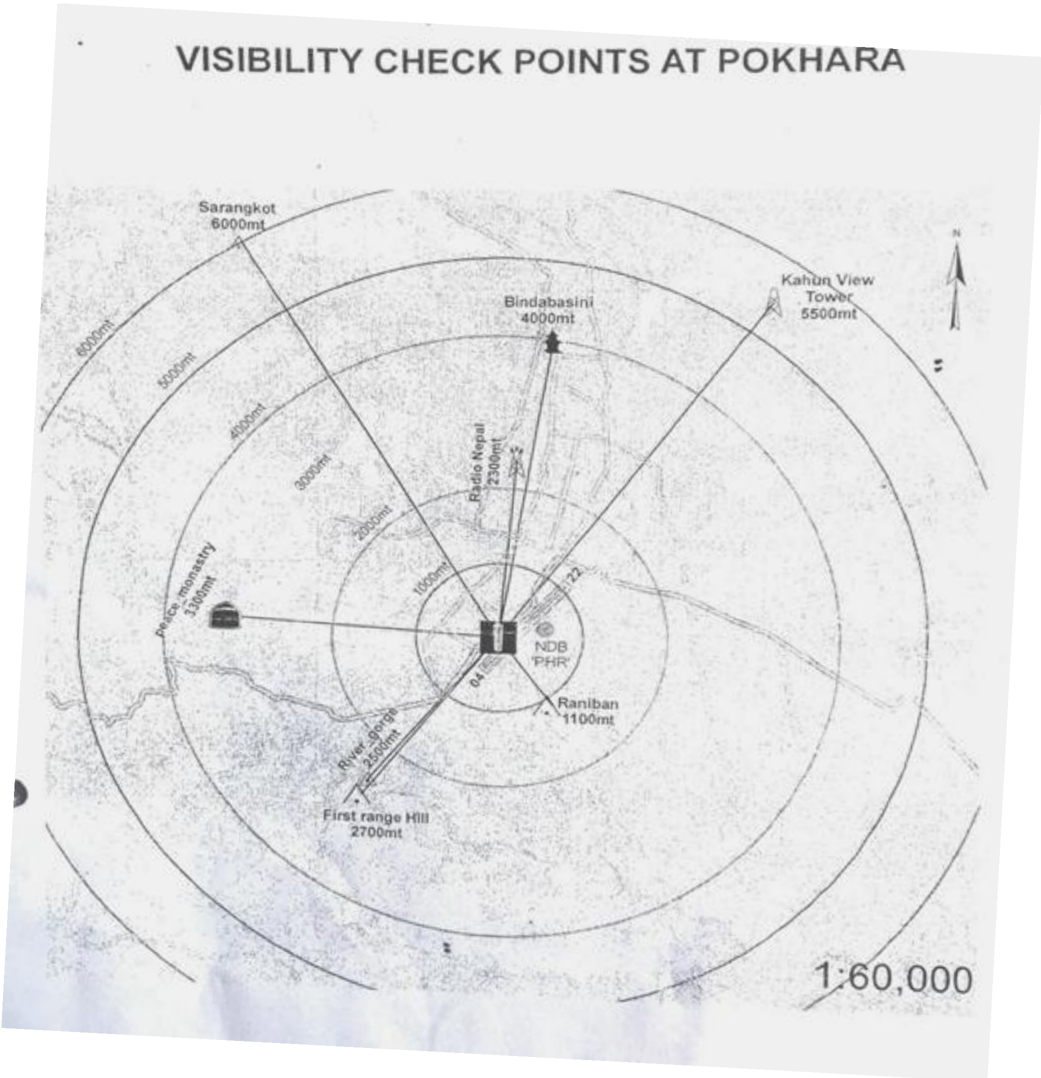


Figure 12: Visibility Check Point Chart

1.6.15 Weather Reported by Aircraft (9N-AHH):

Weather reported by the crew of 9N-AHH on response to the request of 9N-AIL ultra-light aircraft regarding the en-route weather at 0209Z (0754LT): "Light Haze, Mountains not visible but ground contact." (as aircraft passed through 7000 ft.)

1.6.16 Weather at Destination Aerodrome

The prevailing weather condition at Jomsom airport as issued by Jomsom Information was:

Table 4: Weather Observation by Jomsom Information

Time(UTC)	Wind (KT)	Visibility	Cloudiness	Airport Status
0055	NE light	Towards Lete 5 km; towards Kagbeni 10 km;	FEW 010 SCT 050	Operation Normal
0132	CALM	Towards Lete 8 Km; kagbeni 10 Km, Lete foothill faintly visible	FEW 030	

1.6.17 Weather at Alternate Aerodrome

The alternate aerodrome at the time of departure of aircraft was closed. The prevailing weather condition at Bhairahawa airport was as follows:

Table 5: Weather Observation by Bhairahawa tower

Time(UTC)	Wind (KT)	Visibility	Cloudiness	Airport Status
0110	090/02	800m FG	Sky Invisible	Airport Closed
0306	120/03	1600m BR	NSC	IFR Normal

Table 6: METAR at Bhairahawa

Time(UTC)	Wind (KT)	Visibility	Cloudiness	Remark
0050	CALM	1200m BR	NSC	
0150	CALM	1200m BR	NSC	0250 METAR no change

1.6.18 Weather Report at Crash site

At the time of occurrence, the weather around the crash site was low ceiling with cloud base from ground level, light rain, sky and mountain ridges invisible according to nearby eyewitnesses.

1.7 Aids to Navigation

1.7.1 Ground Based Navigation

Pokhara airport is equipped with Distance Measuring Equipment (DME) transmitting on frequency 112.8 MHz, identification code 'PHR' (CHN 75 X; H24, 281203N 0835905E, Declination 0.0° E, Elevation of transmitting antenna 829m) with voice transmission capability. There are no instruments procedures established in Pokhara airport.

Jomsom airport is and AFIS airport which is not equipped with any navigational facilities. The first alternate airport, Gautam Buddha airport; Bhairahawa is equipped with VOR/DME equipment transmitting on frequency 114.7 MHz, identification code 'BWA'* (CHN 94X,H24, 273012 N 0832558 E, Declination 0.0° E, Elevation of DME Transmitting Antenna 112m).

1.7.2 Aircraft Navigation Aids

The aircraft was equipped with Flight Management system (FMS) for area navigation using Global Positioning System (GPS).The other onboard navigation system consisted ADF and VOR, DME, ILS receivers. Additionally, the aircraft is equipped with other navigation aids like: Traffic Alert and Collision Avoidance System (TCAS), Terrain Awareness and Warning System (TAWS), Weather Radar System (WX), Radar Altimeter System.

1.8 Communication

Records of radio transmission between aircraft and Pokhara ATC were available from ATC recording media. The same was also recorded on CVR. Pokhara is a controlled airport. ATS is provided on VHF frequency 123.8 MHz within ATS airspace which includes Pokhara CTR (an area of circle 10NM in radius centered at ARP from ground to 8000AMSL) and Pokhara ATZ (an area of circle of radius 5NM centered at ARP from GND to 2000 AGL). Other sources of communication are HF frequency 5805.5 KHz and telephone facility. Additionally, Pokhara ATC tower is equipped with AMHS link (Automated Message Handling System) installed on March 2013 which can exchange information with other airports like Kathmandu, Biratnagar, Bhairahawa, Dhangadhi, Simara and Lukla.

Radio Nepal transmission disturbance was noted in Pokhara VHF frequency 123.8 MHz that caused difficulty in two way communication between Pokhara tower and aircrafts. In spite of frequent reporting by Pokhara Airport to concerned authorities, the same unwanted interference was noted in the CVR recordings of the fateful flight.

Jomsom airport is an uncontrolled airport which can provide AFIS to all air traffics and is equipped with VHF radio having frequency 122.5 MHz and HF 5805.5 KHz along with reliable telephone services. After departure from Pokhara at 0204 9N-AHH reported Pokhara tower at 5 miles climbing through 6200 feet with estimate Jomsom at time 0226. At 0208 ultra-light aircraft 9N-AIL, belonging to Avia Club, from on ground Pokhara airport requested 9N-AHH the enroute weather condition. Due to unintentional continuous background music; which is identified to be from Radio Nepal; heard in Pokhara tower frequency, the crew of 9N-AHH did not notice the call. In next attempt by 9N-AIL at 0209, Captain passes weather information to 9N-AIL. At 0215 Captain reports position Ghodepani after which the aircraft was advised to contact Jomsom Flight information service on 122.5 MHz. This was the last communication between ATC and the aircraft.

1.9 Aerodrome Information

1.9.1 Departure Aerodrome-Pokhara

Aerodrome Location Indicator	: VNPK
Name	: Pokhara Airport
ARP Coordinates	: 28^{o} 12' 00" N 083^{o} 58' 54" E
Elevation	: 822 m/2696 ft.
Runway Designation	: 04/22
Runway Dimension	: 1444 x 30 m
Runway Surface	: Bitumen
Approach Lights & VASIS /PAPI	: NIL
Runway Lights	: REL available.
Take off/ Landing	: Both Runway
Radio Navigation Aid	: DME
Types of Traffic Permitted	: VFR
ATS service	:ATC service within PKR CTR on 123.8 MHz
Meteorological Information Provided	: METAR
Refueling Facility	: Available
RFF	: Category V

1.9.2 Destination Aerodrome-Jomsom

Aerodrome Location Indicator	: VNJS
Name	: Jomsom Airport
ARP Coordinates	: 28^{o} 46' 52" N 083^{o}43'02" E
Elevation	: 2736 m/8976 ft.
Runway Designation	: 06/24
Runway Dimension	: 739 x 20 m
Runway Surface	: Asphalt Concrete
Take off/ Landing	: Both Runway
Operating Hours	: 0100-0645 (Nov, Dec, Jan, Feb.)

0030-0645 (Mar, Apr, Sept, Oct.)
0015-0645 (May, June, July, Aug.)

Radio Navigation Aid : NIL

Types of Traffic Permitted : VFR

Service : AFIS, Alerting service.

RFF : Category E

Communication Facility : VHF (122.5 MHz), HF (5805.5 KHz)

Refueling Facility : Not Available.

1.9.3 Alternate Aerodrome-Bhairawaha

Aerodrome Location Indicator	: VNBW
Name	: Gautam Buddha Airport
ARP Coordinates	: 27°30'26" N 083°25'05" E
Elevation	: 105 m/344 ft.
Runway Designation	: 10/28
Runway Dimension	: 1500 x 30 m
Runway Surface	: Bitumen
Approach & Runway Lighting	: Available
Take off/ Landing	: Both Runway
Radio Navigation Aid	: VOR/DME
Types of Traffic Permitted	: IFR/VFR
ATS service	: ATC service within Bhairawaha control Zone on 122.5 MHz
Meteorological Information Provided	: METAR
Refueling Facility	: Available
RFF	: Category V

1.10 Flight Data Recorder

1.10.1 CVR:

A four channel Honeywell AR120 Cockpit Voice Recorder (CVR) with 120 minute recording capacity was installed on the aft section (414.50 inch) of the fuselage. The CVR is integrated with Apex system and captures radio communication, intercom communication, and input from a flight compartment area microphone. CVR was recovered in normal condition without any sign of damage. The CVR installed on the aircraft was P/N 980-6023-002 S/N ARCVR-11630.

Figure 13: CVR collected from 9N-AHH

1.10.2 FDR

A Honeywell AR-226 Flight Data Recorder (FDR) with 25 hours recording capacity was installed on the aft section (429.40 inch) of the fuselage. The FDR captures all 88 mandatory parameters specified in regulatory requirements and also captures auto feather status, auto feather activation, and all warning and caution level CAS messages that are displayed by the Apex system. FDR was recovered in normal condition without any sign of damage. The FDR installed on the aircraft was P/N 980-4710-003 S/N ARFDR-02584. Transcript of the flight recorders is attached in Appendix I.

Figure 14: FDR collected from 9N-AHH

1.10.3 Additional source of Recorded Information

The additional source of recorded information included ground based radio telephony (RTF) recordings between the crew and controllers during the flight provided by Pokhara Control tower. Similarly, information obtained from MAU (Modular Avionics Unit) and EGPWS, TCAS installed in the aircraft are other vital sources of recorded information.

1.11 Wreckage and Impact Information

The aircraft was found with single fuselage section, detached tail structure and dispersed main landing gear, propellers and cowlings. The fuselage, resting on its upper side, was mostly consumed by the fire. The instrument panels were damaged by the impact force and partially destroyed by fire and all the cowlings and fairings were in a damaged condition. Based on the data collected during the crash site visit by the commission members; the following observations were made:

- The airplane initially impacted with its belly and tail portion which was then separated from the main structure
- The point of first impact was approximately 77 meters from the main fuselage resting position refer Appendix-B.
- The measurements of the main impact area were 400 meters long by 50 meters wide, with the wreckage aligned on a heading of flight.
- Moving from the location of where the airplane hit the ground, the fuselage, the right wing and right engine touched the ground after belly impact and left engine was the last items that might have impacted after some time on the wreckage path. The fuselage came to rest mostly intact on its right side and was located about 75 meters from the first impact point. Both wings, with the engine attached, was lying inverted just in the fuselage wreckage. Both engines were found attached to the fuselage with evidence of propeller breakage after impact. Both engines propeller assembly were in attached condition with burn marks. Both engines and propellers had evidence of rotation and power at impact. (Refer Figure of crash site location Appendix-B)
- FDR/CVR/ELT were located along with aft fuselage area around 1000 m away downslope of the main crash area

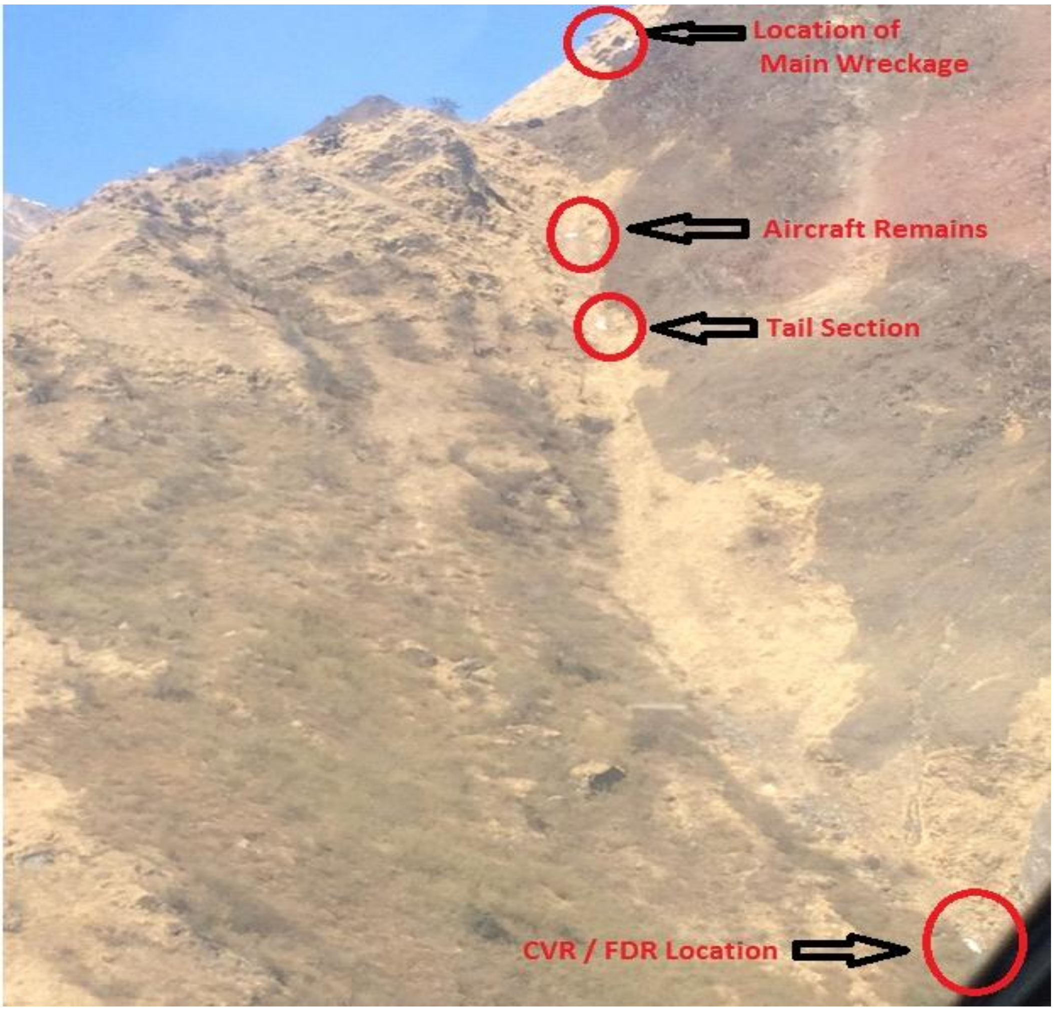


Figure 15: Scattered Debries

The aircraft flight conditions before impact on ground as per FDR records were as follows:

CAS= 93 Knots
GS=119 Knots
Pitch= 7.7
Elevator Position=14.9
Roll =25.7 Left
Magnetic Heading=333.5
Wind Component=138.9 degree, 10.8 knots
OAT=1.8
Vertical Acceleration= -2.354g
Pressure Altitude =10606ft (@ QNH 1018)
Radio Alt= 368 ft. (evidencing impact with steep terrain)
Stall Warning= Not Active.
GPWS Warning =Active.
Engine Parameters = In normal cruising conditions.

1.12 Medical and Pathological Information

1.12.1 The Pilot in Command

1.12.1.1 Medical History

During his training and during his activity as a pilot, the captain was regularly examined, medically and psychologically. The flying-related medical examinations took place according to the Civil Aviation Authority of Nepal requirement which provided for extensive clinical examinations. The regular checks were carried out once a year by CAAN authorized medical doctors.

The regular checks were documented in hand-writing in a medical form developed by CAAN, which is available in full. Decisions on fitness to fly were therefore taken on the basis of the regular examinations by the medical examiner after all examination in three areas, general physician, ENT and Eye, is complete. The clinical examinations also include medical/technical examinations such as audiometry, electrocardiography, laboratory and x-ray examinations, etc as per the age and time interval.

As per the medical record,

- The only relevant medical finding is short-sightedness of –2 dioptres, which was corrected satisfactorily with spectacles
- No health defect existed prior to or to the time of the accident.
- Previous medical history and findings of examinations, as well as interviews with family members and acquaintances, give no indications of abuse of alcohol, medicines or drugs.

Last medical was completed on April 2015.

1.12.1.2 Medical Forensic Findings

As a result of the very high impact energy and post impact fire, all occupants of the aircraft suffered very serious injuries to all vital organs and many suffer up to 4th degree burn. All occupants, including the captain, were identified either by personal belonging or DNA profiling. The captain was identified based on dental findings and personal belongings.

Because of the massive destruction, the cause of the death as reported by the report is due to multiple blunt trauma all over the body.

1.12.2 The Co-Pilot (F/O)

1.12.2.1 Medical History

The F/O was regularly examined, medically and psychologically. The first last medical took place in Kathmandu on December 2015. The only relevant medical finding is

- Short-sightedness (Right Eye: -1 and Left Eye –1.25 dioptres), which was corrected satisfactorily with spectacles.

- No health defect existed prior to or to the time of the accident.
- Previous medical history and findings of examinations, as well as interviews with family members and acquaintances, give no indications of abuse of alcohol, medicines or drugs

1.12.2.2 Medical forensic findings

Due to high impact energy and post impact fire, identification of first-officer was possible only through DNA profiling. The cause of death is also reported due to multiple blunt trauma all over the body.

1.13 Fire

The investigation of the crash site, scatters of debris on flight path and available evidence showed that the fire was the post impact event caused by engine combustion and spilled fuel around the vicinity of the crash site.

Figure 16: Post impact fire

Post impact fire was evident mainly at the fuselage area and as the fuel is stored in the belly of the main fuselage area the whole main fuselage structure was consumed by the fire. The rescue team who reached the crash site also reported that the fuselage area was still burning at the time they arrived the site which was more than 5 Hours after the accident. The FDR and CVR record reveals that there was no evidence of fire before impact and examination of the wreckage confirms that the fire occurred only after the impact.

1.14 Survival Aspect

As per the FDR data, the aircraft hit the ground at speed of 92 knots CAS. The impact of the collision with the terrain caused the immediate death of all the occupants of the aircraft. The remains of the main fuselage area is depicted below:

Figure 17: Main wreakage area

1.15 Tests and Research

The Commission had conducted survey and investigation of the crash site twice during the investigation phase. Flight Recorders and other equipment (FDR, CVR, TCAS, EGPWS and MAU) collected during crash site visit were carried to TSB, Canada for necessary test and analysis.

1.15.1 Human Factor

During the course of the interview with different pilots and from the analysis of the FDR data retrieved from other flights in the Pokhara Jomsom sector the following facts were revealed:

- The crew had a preference of runway 04 over runway 22 in pokhara due to shorter taxi distance
- As long as Jomsom weather was 5 km, other factors such as closure of alternate airport, returning aerodrome weather, enroute weather factors were not taken into consideration by the crew.
- Preference of completing the flight as soon as possible
- Due to frequent occurrence of EGPWS alert and warning; crew became habitual and in most of the cases ignored the occurrence.
- Due to new avionics system, crew had confusion regarding the system, espically the Track and heading function and the correct procedure to regain the course.
- Being a management pilot, the captain was made aware regarding the affect of earthquake and blockade on the airline flight operations and financial condition which could have made the pilot to take additional initative in completing the flights.

1.15.2 Autopsy

Autopsy of 3 bodies were carried out in Mustang District Hospital; 9 bodies in Kaski Regional Hospital and 11 In Kathmandu Autopsy center, Tribhuban University. Out of the 11, the identification of 3 bodies were through the DNA profiling. The main cause of death as per the Autopsy was Multiple Blunt Trauma.

1.15.3 Terrain Awareness Warning System (TAWS)

In 1970's accidents involving aircraft inadvertently flying into terrain or obstacles due to a crew's loss of situational awareness became known as Controlled flight into terrain(CFIT)*.The Ground Proximity warning system (GPWS)was developed to alert crews if aircraft's rate of descent near the ground , or terrain closure rate were hazardous. Additional features were subsequently added to provide: automatic height call outs during approach and alerts if the aircraft was not in the correct landing configuration, descending below the ILS glide slope and at high bank angles when near to ground. This system still has some technological limitation. Under some circumstances such as when approaching steeply rising terrain, alerts could occur too late to prevent an accident due to the use of downward –pointing radio altimeters sensors used to measure the aircraft height above terrain.

In late 1990's technological advancement enabled development of the Enhanced Ground Proximity Warning System (EGPWS*) which added a look ahead capability to the existing GPWS classic modes using digital terrain and obstacle database in conjunction with aircraft position and flight path information. The generic name of TAWS has been internationally adopted.**EGPWS is a proprietary name used by Honeywell Aerospace for its TAWS system.*
Tara air Operations manual has mentioned following provision in regard to Ground proximity warning systems (GPWS/EGPWS):

- Company turbine engine aeroplanes of maximum certified takeoff mass in excess of 5700 kg or authorized to carry more than 9 passengers shall be equipped with ground proximity warning system.
- The aeroplanes of a maximum certified take-off mass in excess of 5700kg not installed with GPWS shall be limited to VFR operation only.

From close scrutiny of terrain data provided by TSB Canada it was noticed that the instrument was fully functional till last moment. This fact is further supported by activation of TAWS cautions and warning which were recorded in the CVR and FDR. During course of investigation and observation of flight data, it was found that EGPWS warning occurred in different places in Pokhara-Jomsom sector. As revealed through interviews, such warnings were common phenomenon in other sectors where aircrafts has to pass through high terrains. Due to the repetitive cautions and warnings, crew might have been habitual for such occurrences. It was noted that there was no reporting made by crew regarding occurrence of such GPWS/EGPWS alerts /warnings.As per the FDR analysis, INHIBIT function was not activated.

Though FOR, CAAN mandated installation of TAWS, no training requirement was specified on the installed system till the day of occurrence. Later on; Flight Safety Standards Department of CAAN issued Advisory circular CAAN AC # 01/2016 "*Guidance for Operators on Training Programme on the use of Ground Proximity Warning System (GPWS)"* with effective date April 2016.

1.15.4 Fuel Status

Aircraft was refueled in Pokhara airport on 23rd February 2016 with total of 1200 lbs (fuel endurance of 2 hours) of fuel on-board.Contrary to the amount of fuel uplifted, it was observed that the fuel endurance filed in flight plan was 2 hours 30 minutes.

1.15.5 NOC procedure

As per the information provided by Nepal Oil Corporation (NOC), following facts were summarized.

a) There is no procedure to keep fuel sample during refueling. If an organization request for quality check during refueling, spot quality check can be performed (Visual, Aquadis, Density and Temperature). According to 'Quality Control and Assurance Manual on Aviation fuel' of NOC, if an aircraft involves in accident, NOC will keep two sample of fuel collected from the refueling vehicle. Then, as and when required one sample will be sent to concerned authority and one sample will be kept in custody of NOC.
b) 9N-AHH refueling was done on 23rd Feb 2016 at 11:30 AM with 280 liters of ATF Jet A-1 using vehicle no. AR30. On the same day, a total quantity of 3270 litres of fuel was refueled in 10 different aircrafts. Out of 10 refueling, 5 were done before 9N-AHH and 4 refueling were done afterward. Once the crash information of 9N-AHH was received, NOC had collected two samples from AR-30 refueling vehicle. One sample was sent to investigation commission and another was kept in NOC office.

1.15.6 System Bench Simulation of Accident Flight Path

System bench simulation base on FDR data was performed by Honeywell upon the request of Transport Safety Board of Canada (Refer Appendix F). The pictures are presented with and without Synthetic Vision System (SVS) displayed. The objective of the simulation was to demonstrate the cockpit environment just before the impact. Total 8 waypoints were chosen randomly and entered in to the system bench for the simulation, the last waypoint (P0009) being the last recording point of the FDR.

1.16 Organization and Management Information

1.16.1 Tara Air Pvt. Ltd.

Tara Air Pvt. Ltd., a subsidiary of Yeti Airlines, was established in 2009 with its head office located in Kathmandu, Nepal. The Air Operator's Certificate (AOC), valid on the date of the accident, was first issued by CAAN on 28th May 2009. The main base of operation is Tribhuvan International Airport and secondary hubs at Surkhet, Nepalgunj and Pokhara. As of the date of the accident, Tara Air was operating scheduled and charter flights with 5 Twin Otter (DHC 6/300 and 400) and 2 Dornier (DO 228) aircrafts.

1.16.2 Oversight of flight Operations

The CAAN approved Operations Manual (OM) of Tara Air defines the procedures for the operations of aircraft in accordance with requirement prescribed by CAAN.

- *Audits*

It was observed that in-house audits were carried out on a regular basis and necessary corrective actions were taken.
CAAN had audited the airline before the renewal of the AOC on May 10, 2015 however the findings of the audits were not given to Tara Air.

- *Flight Data Monitoring (FDM)*

The Operator had implemented CVR/FDR monitoring at Kathmandu on all other fleet except DHC-6/400, which being new type the airline did not have the equipment to download and analyze the CVR/FDR data. The 9N-AHH being Dhc-6/400 series was mostly stationed at Pokhara since the time of its arrival and not CVR/FDR monitoring was conducted.

Tara Air had implemented Safety Management System (SMS) and Voluntary Reporting System (VRS), however during the course of interview it was revealed that the system is not effective as pilots are very reluctant on making or submitting any such voluntary reports.

1.16.2.1 Operating Procedures

The OM contains following information about weather requirement for VFR flights:

Table 7: Weather Requirement for VFR flights

	Airspace Class C	Airspace Class G	
Distance from cloud		Above 900m (3000 ft) AMSL or above 300m (1000ft) terrain whichever is the higher	At and below 900m (3000ft) AMSL or 300M (1000ft) above terrain whichever is higher
	1500m horizontally 300m(1000ft) vertically	1500m horizontally 300m(1000ft) vertically	Clear of cloud and in sight of the surface
Flight Visibility	8 km at and above 3050(10000ft)AMSL 5km below 3050m (10000ft)AMSL	8 km at and above 3050(10000ft)AMSL 5km below 3050m (10000ft)AMSL	5 km or 1000m for helicopters

1.16.2.2 SOP

The SOP also defines the following procedures for terrain alert/warning:
"Every alert should be considered valid and requires appropriate action. An RED annunciator indicates a WARNING and requires immediate aggressive pilot action."

Following warnings and callouts are also included in the SOP:

Table 8: EGPWS Warnings

<table>
<tr><td>Caution Terrain
(FLTA Caution)</td><td>FLTA</td><td>'Visual Noted'</td><td>If level, apply power, establish a climb attitude, and climb out of alert. Check position on terrain display.
If descending, apply power and level off. If caution continues, apply power and establish a climb attitude.</td></tr>
<tr><td>Pull Up(GPWS warning)</td><td>ERD
ECRTNL
ECRTL</td><td rowspan="3">'Visual Noted'
Or
'Visual Correcting'(if required)</td><td rowspan="2">Disengage autopilot/immediately level wings.
Apply full power, establish a climb attitude.
Continue maneuver until alerts ceases or terrain clearance is assured.</td></tr>
<tr><td>Terrain Pull Up
(FLTA warning)</td><td>FLTA</td></tr>
<tr><td>Terrain, Terrain(GPWS warning)</td><td>ECRTNL
ECRTL</td><td>Apply power, level wings, and establish a climb attitude.</td></tr>
</table>

1.16.2.3 Flight Duty Time

Following is the provision set out in Tara Air's Operations Manual Part-A regarding Flight Duty Time Limitation:

For Domestic STOL Operations: "The flight duty period in any period of 24 hours for pilots engaged in two pilots operations shall be 10 hours of which not more than 8 hours of operations by airplane."Since it was the first flight of the day the flight crews were well within the flight and duty time limitations.

1.16.3 Civil Aviation Authority of Nepal (CAAN)

In 1957, the Department of civil aviation was formally established under the then Ministry of work, communications and transport of the Government of Nepal. The statutory regulations regarding civil aviation were introduced under the Civil Aviation Act, 1959(2015BS). Nepal obtained the membership of International Civil Aviation Organization (ICAO) in 1960.

Civil Aviation Authority of Nepal (CAAN) was established as an autonomous regulatory body on 31st December 1998 under Civil Aviation Authority Act, 1996. The prime objective is to develop and expand civil aviation in Nepal and to provide for the establishment and operation of the Nepal Civil Aviation Authority in order to make the operation of air flights, air communication, air navigation and air transportation services for national and International air contacts safe, regular, standard and efficient also to ensure flight safety and sustainability of civil aviation. It has the responsibilities of constructing, operating and maintaining airports. Flight safety standards department of CAA Nepal is responsible for safety oversight and personal licensing. Pokhara airport is operating as a western regional hub under the Civil Aviation Authority of Nepal.

Civil Aviation Authority of Nepal (CAAN) is responsible for establishment and provision of search and rescue services within Nepalese territory in coordination with other agencies to ensure that assistance is rendered to persons in distress. Such services shall be provided on a 24-hour basis. Presently, RCC office is setup at TIA, Kathmandu.

1.16.4 Ministry of Culture, Tourism and Civil Aviation (MoCTCA)

Ministry of Tourism first came into existence in 2035 BS (1978 AD). In 2039 (1982 AD), Civil Aviation was also merged into the Ministry of Tourism and it became the Ministry of Tourism & Civil Aviation. In 2057 (2000 AD), Culture was also integrated in the Ministry and called the Ministry of Culture, Tourism & Civil Aviation (MOCTCA). In August 31, 2008 (B.S. 2065-5-15) the ministry was divided into two ministries, i.e. Ministry of Tourism and Civil Aviation and Ministry of Culture and State Restructuring. Once again it became Ministry of Culture, Tourism & Civil Aviation (MOCTCA).

This Ministry is responsible for all civil aircraft operation under CAAN (Civil Aviation Authority of Nepal). Ministry also carries out the detail investigation with regards to any accident, it may set up an independent Accident Investigation Commission for carrying out the investigation of such accident and submit the report thereof.

1.16.5 Department of Hydrology and Meteorology (DHM)

The Department of Hydrology and Meteorology is an organization under the Ministry of Population and Environment, Government of Nepal. The department with headquarters in Kathmandu has three basin offices: Karnali Basin Office in Nepalgunj, Narayani Basin Office in Narayanghat and Koshi Basin Office in Biratnagar. Meteorological activities in the Far_Western and Mid-Western region are managed by a regional office in Surkhet, whereas such activities in the Western Development Region and the Eastern Development Region are managed by meteorological regional offices located in Pokhara and Dharan respectively. This is the meteorological authority of Nepal that forecasts, analyses and disseminates weather report for aeronautical purpose also.

1.16.6 Nepal Oil Corporation (NOC)

Nepal Oil Corporation Limited is a state owned trading enterprise of Nepal to deal with the import, transportation, storage and distribution of various petroleum products in the country. It was established on 1970 by the Government of Nepal under the "Company Act, 2021 (1964)". The government owns 98.36% of its share and rest is contributed by four other state owned enterprises: Rastriya Beema Sansthan, National Trading Ltd., Nepal Bank Ltd. and Rastriya Banijya Bank. NOC, headquartered in Kathmandu, has over the years expanded and now has five regional offices, branch offices, fuel depots, and aviation fuel depots, with total existing storage capacity of 71,558 kilolitres and employing 508 permanent and other contract work force. It also serves as a supplier for ATF for all aircrafts operating in various airports of Nepal.

1.17 Additional Information

1.17.1 Responsibilities of Meteorological Services

The department of hydrology and meteorology provide meteorological services for civil aviation .the service is provided in accordance with provision of ICAO documents within Kathmandu FIR. Pokhara aero-synoptic station provide METAR for Pokhara Airport.

1.17.2 Responsibilities and Authorities of PIC

Pilot in command is responsible for the flight operations, safety and security of the aircraft, crew and passenger onboard during the flight. He/she shall ensure that the operations are conducted in accordance with applicable regulations, company standard and AOC issued by CAAN.

Pilot in command of the flight may reject an aircraft prior to departure of the flight if he/she is dissatisfied with any aspect of airworthiness of aircraft, adverse meteorological conditions, flight safety and security.

1.17.3 Duties and Responsibilities of F/O

The Co-pilot should act as subordinate to the pilot in command during flight. He is expected to report to pilot in command any abnormalities and deficiencies, which may influence flight safety and security of the aircraft. Advice PIC on all operational matter as asked by him and if in his opinion some item has been overlooked, remind him and be prepared for the actions to be followed in an emergency.

1.17.4 Duties and Responsibilities of ATC, Pokhara

As per the MATS Nepal, Aerodrome control service shall be provided by an aerodrome control tower. Aerodrome control tower shall issue information and clearances to aircraft under their control to achieve a safe, orderly and expeditious flow of air traffic on and in the vicinity of an aerodrome with the object of preventing collision(s) between:

- aircraft flying within the designated area of responsibility of the control tower, including the aerodrome traffic circuits;
- aircraft operating on the manoeuvring area;
- aircraft landing and taking off;
- aircraft and vehicles operating on the manoeuvring area;
- aircraft on the manoeuvring area and obstructions on that area.

Aerodrome controllers shall maintain a continuous watch on all flight operations on and in the vicinity of an aerodrome as well as vehicles and personnel on the manoeuvring area. Watch shall be maintained by visual observation, augmented in low visibility conditions by an ATS surveillance system when available. Traffic shall be controlled in accordance with the procedures set forth herein and all applicable traffic rules specified by the ANSP. If there are other aerodromes within a control zone, traffic at all aerodromes within such a zone shall be coordinated so that traffic circuits donot conflict.

The Controllers working in Pokhara Towers (Active controller and Co-ordinator) at the time of accident were authorized to provide Air Traffic Control Service under the supervision of Rated Controllers of Pokhara Tower.

1.17.5 Flight Data Simulation

CVR, FDR, EGPWS, MAU, TCAS were recovered from the crash site which were sent to TSB Canada for the data downloading, readout and the analysis. As of the date of submission of this report, only CVR and FDRdata were available. Aircraft flight animation was prepared for presentation based on the CVR and FDR data. If significant information is retrieved from remaining equipments, it will be incorporated in final report.

1.18 Search and Rescue (SAR) Operations

1.18.1 Chronology of Search and Rescue

The SAR within VNSM is organized by CAAN in collaboration with other governmental agencies. The SAR operation for 9N-AHH is activated once the aircraft did not report to Jomsom tower (AFIS). The further action is activated from Pokhara tower and also RCC at TIA. Due to non activation of ELT signal from the ill fated aircraft the search operation by different organization from air could not locate until some indication fire and smoke observed by local people reported to the police by mobile have some light thrown to air search and helicopter search has found the crash site only after more than 5 hours time from the last contact of aircraft. This need some review on ELT system and satellite ground station. The SAR focal point of COSPAS SARSAT in Nepal is designated to the chief ATS/SAR.

a. 07:50 LT :9N-AHH departed PKR and last contact with PKR Tower was at 08:00LT(0215Z) while reporting over Ghodepani enroute from Pokhara to Jomsom at an altitude of 10500 ft on PKR QNH and estimate JOM 08:11 LT (0226Z).
b. 08:20LT: (0235Z) Trying to contact the aircraft started after JOM AFIS reported at 0813LT (0228Z) to Pokhara tower that no contact with 9N-AHH.
c. 08:55LT: Air Dynasty helicopter 9N-AFQ starts search operation from Pokhara.
d. 08:57LT: RAN-45 start search operation from Jomsom.
e. 09:15 LT: Distress phase declared by RCC TIA.
f. 10:11LT: Air Dynasty helicopter 9N-ALA departed Kathmandu for search area (Dana).
g. 11:50 LT: Nepal army helicopter RAN-45 started again for search.
h. 12:15LT: Ground search activated by District Police office Myagdi, under command of DSP with 15 police personal. Border police Bhurung, Myagdi

activated ground force under command of inspector with 15 police personal and local police office Dana, Myagdi activated under command of sub-inspector with 5 police personal.

i. Around 13:25LT: the crash site of aircraft 9N-AHH was found in Solighopte, Dana VDC, Myagdi district. All passenger & crew on board aircraft found dead at the crash site as reported by security and local personnel who reach at the crash site.
j. By mobilization of security force, dead body were collected but could not rescued because of weather & helicopter could not land near crash site.
k. Dead bodies were rescued only next day.
l. Director of Pokhara airport is designated as focal point for further action.

1.18.2 Emergency Locator Transmitter (ELT)

a. The ELT was on board the aircraft 9N-AHH.
b. Type and specification are as follows:
c. 08:30LT (0245Z): RCC requested INMCC Bangalore to look for ELT signal.
d. 0900 LT (0315Z): Again RCC requested INMCC Bangalore providing beacon ID 3966E152CAFF8FF of 9N-AHH to check for any signal of ELT.
e. Coordinate given:
   Crash site: 28°34'33.03"N
   83°36'54.04"E
   Elevation: 3300m
   Helipad coordinates:
   28°34'28.5"N
   83°36'54.02"E
f. ELT, CVR, FDR units were found and recovered from 1000m below the point of main wreckage.

2 ANALYSIS

2.1 Introduction

Analysis of the events was done considering fact-based information, psychological factors, physiological factors and mechanical factors. Several discussions were held among the members and experts including AAIB UK Inspectors and TSB Canada experts, especially on the possibility of the human factors, medical and pathological reports, violation of regulations, conditions of crash site, aerodynamics and oxygen deficiency in high altitude and other operation/technical aspects retrieved from flight recorders.

2.2 Methodology

The following methodology was adopted by the Commission during the investigation to reach the conclusion on the probable causes of the accident.

a) Visit of the crash site.
b) Visual examination and assessment of wreckage. Photographs and videos were collected for detailed study
c) Wreckage distribution plotting
d) Collection and study of the prevailing weather report received from Pokhara tower
e) Collection and study of technical documents related to the maintenance and operational history of the aircraft
f) Interview and written evidence collection with all the concerned.
g) Study of personal files and information about the crew
h) Study of mechanical factors human factors, aviation medicine
i) Review of the CAAN regulations/requirements regarding aircraft operations.
j) Study and analysis of personal files and other related information about the crew member.
k) Fight parameters which were retrieved from FDR, CVR, MAU, EGPWS and TCAS with the help of TSB Canada were analyzed.
l) Simulation were prepared with the help of all available data.

2.3 Visits to the Crash Site

The Commission members visited the crash site to study the nature of the accident and to collect necessary data and information regarding the accident. The initial visit was done on 29th February 2016 to gather the initial information, examine the wreckage, measure the wreckage distribution and establish flight profile. The second visit was conducted on 19th March 2016 to verify the established flight profile, retrieve the MAUs, EGPWS, TCAS and for further investigation of the wreckage and nature of distribution of the wreckage.

2.4 Mechanical Factors

There were no indications of any pre-existing technical defects which would have caused or contributed to the accident. The following can be summarized regarding the technical aspect of the aircraft during the accident:

- No evidence of engine failure was recorded in FDR until the impact of the aircraft. From the wreckage investigation and the ground markings it was evident that even after the first impact, the engines were operating and caught fire. Hence the possibility of engine failure is ruled out.
- There was no evidence of any system or primary flight controls failure during the flight. Hence, the failure of the aircraft systems e.g. hydraulic, flight control, and other major components can be ruled out. The probability that the power-plant, system, or structural failures or any other mechanical malfunction contributed to the accident can be ruled out.
- No indication of Maintenance lapses was observed. The Commission examined the maintenance history of the aircraft and found that all the airworthiness directives and service bulletins had been complied with as per the maintenance requirements within the prescribed time frame. The technical logs and log books show that the maintenance works, major inspection works and modifications were carried out as per the approved maintenance program and bulletins. No technical defect was found in the technical logbook prior to the flight.
- Compass swing was not carried out after the initial compass swing which was carried out at manufacturer site, Canada.

On the basis of available evidence, any technical or mechanical reason has been discounted.

2.5 Weather Factor

The weather reports, satellite imagery and weather condition at the time of accident as report by eye witness nearby the area of the crash site, which are presented in the section 1.7 Meteorological Information, confirm that weather enroute to Jomsom was marginal for the completion of flight. Based on the available weather data and FDR/CVR analysis the following observations were made:

- although the weather was not good for visual flight, the performance of the aircraft was not impaired by any weather phenomena such as wind shear, severe turbulence, up or down drafts, thunderstorm and/or icing conditions.
- As per METAR and the interview, weather condition at Pokhara during the time of departure was marginal.
- Despite the fact that the alternate aerodrome, Bhairawaha, was closed due to weather, the crew decided to conduct the flight to Jomsom.
- There is a tendency amongst crew to disregard the alternate weather condition or the weather of the departing aerodrome. This was evident from the fact that on 23rd despite Pokhara was opened for departure only due to bad weather and alternate

aerodrome, Bhairawaha, was also closed due to bad weather, the crew decided to conduct flight from Pokhara to Jomsom.

- The captain considering the bad weather condition for the departure towards runway 22 expressed his dissatisfaction with the F/O regarding change of the takeoff runway from 04 to runway 22.
- During the interview with ATCs it was revealed that the reason for runway change was due to better visibility toward takeoff path from runway 22.
- Due to the prevailing weather condition, the pilot, in several occasion, entered into the cloud while enroute from Pokhara to Ghodepani. The comment made by the captain in response to weather information request by 9N-AIL ultra-light aircraft at 0209Z (0754LT) was also one of the evidances about this fact.
- Flight path comparison between the day of occurrence and previous day also establish that crew followed track left of normal track during most of their flight.
- the average wind direction and speed between Ghodepani and the Crash site at that time of the accident was 117 degrees and 8 knots i.e. easterly wind which caused the cloud build-ups to shift from east to west. Thus; one of the reasons for crew deviation towards left of the track could be to circumnavigate the cloud build-ups.
- After Ghorepani also the flight continued to maintain in-and-out of cloud and at the time of the accident the aircraft was completely inside the clouds.
- It was noted that no weather facilities or weather information are available for the enroute.

Considering all the available information; that weather factor was one of the main contributing factors of the accident.

2.6 Preflight Events

The following observations were made regarding the pre-flight events:

- Flight plan was filed on 23rd of February at Pokhara tower.
- The crew had enough rest period for the flight.
- The crew reported for the duty as soon as the Pokhara airport was opened, which was the usual practice.
- All preflight checks and checklists were conducted.
- Refueling was also conducted on 23rd of February at Pokhara NOC station.
- Aircraft Daily Inspection and pre-flight inspections were also carried out on 23rd february.

2.7 Flight path

Aircraft took off from Pokhara at 02:04 from runway 22 heading towards south. After departure at around 500 ft AGL, the aircraft turned right to maintain a heading of 305 degree towards Ghorepani. After reaching Ghorepani area at 02:14; aircraft turned right to initially maintain a heading of 330 while maintaining 11,500 ft.

Last 3 minute of the FDR data showed that the aircraft frequently changed its pitch and roll attitude in an attempt circumvent cloudy weather. Following picture illurates the actual flight path flown by the aircraft on the day of the accident (Green Coloured line) in comparision to the flight path of the aircraft the day before (Magenta Colour line). The CVR revealed the fact that the pilot had assumed the track to follow was to the left, which could be due to the wrong interpretation of the Track and Heading function of the EFIS.

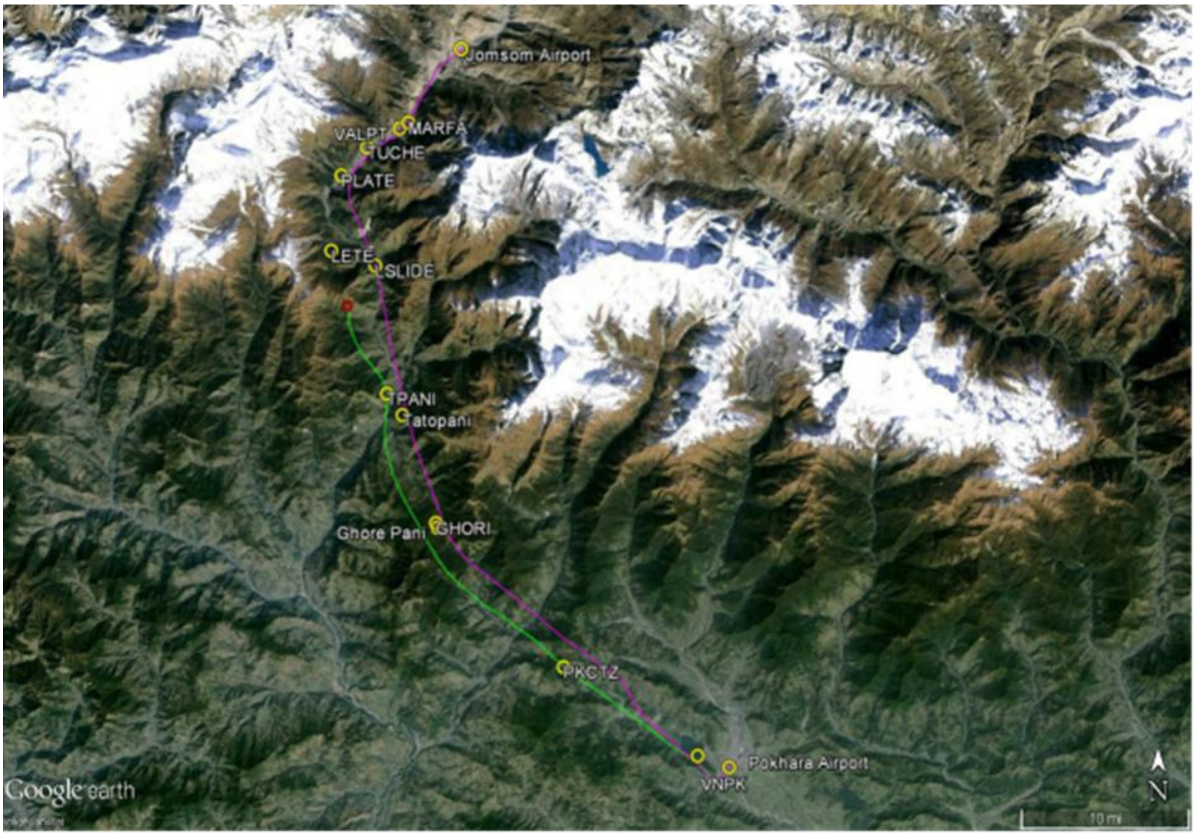


Figure 18: Flight path to Jomsom from Pokhara

2.8 EGPWS Activation

FDR and CVR data revealed several events of EGPWS cautions and warnings in PKR-JOM sector. Data from previous flights also revealed that crew failed to take appropriate corrective action for EGPWS alert/warning activation due to the fact that they became habitual to frequent EGPWS alert/warning in the PKR-JOM sector. On course of investigation, it was noted that the crew did not report occurrence of such GPWS/EGPWS cautions/warnings. However, as of the date of occurrence, such reporting was not made mandatory.

2.9 Accident Sequence

The aircraft took off from Pokhara with twenty three persons on-board including two infants and 3 crew members. After around 15 minutes into the flight aircraft met an accident due to CFIT in to the rocky terrain at an altitude of around 10,700 ft (FDR readout data).

Aircraft was flown left of the usual track to Jomsom. As per FDR and CVR data the decision to turn to left heading assuming that they have reached landslide (a waypoint after tatopani en-route to Jomsom created by the airline) was totally wrong in the real world, as the aircraft had never reached the said (landslide) waypoint. Furthermore, the crew continued descended as low as 9500 ft in an attempt to maintain visual condition in between the cloud layers despite the fact that the EGPWS warning was active, until they reached a point after which it was not possible to maintain VMC. The crew continuing on Northwesterly heading while inside the cloud, wanted to make right turn to return back but as there was weather on the right side turned left but during the turn the aircraft hit the ground first with the belly near the tail section which was then detached from the main fuselage. After the detachment of the tail portion from the fuselage, the aircraft slammed the ground and rested in the final position as shown in appendix: A

2.10 Enroute Facility

In the course of investigation, it was noticed that after passing Ghodepani until reaching position Lete there is no two way communication in VHF with either Pokhara ATS service or Jomsom AFIS. i.e. there is communication buffer zone lasting 3-4 minutes of flight time where no VHF communication with aircrafts can be established. This fact was found to have been reported in Air Navigation Services (ANS) Inspection Report conducted at Jomsom aerodrome in 2015.

In this zone aircrafts are found to maintain required separation by establishing communication with each other or based on traffic information provided by Pokhara ATS or Jomsom AFIS. Two way communications with Air traffic controllers can be made anytime in HF frequency.

2.11 Human Factors

2.11.1 Flight Overview

There is a very thin line between the normal error in judgment by an experienced pilot and mild impairment of judgments induced by special disorientation. The latter may never be noticed because disorientation at no time leaves any telltale signs other than its end results. As with many accidents, the end result depends on many factors. This analysis considers certain factors which may have had a bearing on the outcome and/or which could have prevented the accident. Human factors including negligence on the part of the captain and bad decision to enter in to IMC were also main contributing factors of the accident.

2.11.2 HFACS

The commission decided to carry out in-depth humanoid aspect examination of this accident. A systematical analysis of the accident was carried out to determine the primary factor or casual factor of this accident following the guideline of HFACS framework. The framework is listed in Appendix-C. CVR/FDR data and interactions with concerned personnel of different aviation organizations revealed some underlying problems of human factor associated with this accident as tabulated below.

Table 9: HFACS

PARAMETER	EVIDENCE	SOURCE	EFFECT	OTHER INFORMATION
1) Unsafe Acts				
Decision Error of Crew	Decision to depart without considering availability of first alternate aerodrome	ATC/CVR recording and Weather of first alternate aerodrome	No direct effect	Risk taking
	Decision to continue even by entering into the cloud	CVR recording	Causal/ Contributory	Significant effect in this accident
Skill Base error of Crew	Less time on DHC-6/400 with APEX system	Log Book records	Circumstantial	Electronic cockpit significantly different
	No response to EGPWS Warning	CVR/FDR recording	Causal	Significant effect in this accident
Perceptual error	Loss of situational awareness	CVR/ FDR recording	Causal	Misidentification of a waypoint “Landslide” Significant effect in this accident
Routine Violation	No response to EGPWS in IMC	Interview with other crews/ CVR recordings	Contributory	Possibly de-sensitized
2) **Preconditions for Unsafe Acts**				
Loss of Situational awareness	Mis-identifying aircraft position	CVR Recording	Causal	Significant effect in this accident
Complacency	Flight departed without alternate assured	CVR/ATC Recording	No direct effect	Captain only
	Continue into IMC and	CVR Recording	Contributory	Captain only

	reassuring F/O			
Fail to use all available resources (Lack of CRM)	F/O failed to be assertive and more interactive during critical phase of flight	CVR Recording	Contributory	Cockpit gradient
	TAWS display and warnings not managed	CVR/FDR Recording	Contributory	Thrust, Pitch and Display range
Mission not in accordance with rules/ regulations	Inconsistent meteorological information and allowed crew to depart without alternate	ATC Recording CVR METAR	Circumstantial	
	IMC encountered on en-route and flight continued	CVR recording and FOR Provisions	Contributory	Common practice
Failed to provide skill based training on EGPWS	Lack of appropriate response	Training reports/ Conversion training programs	Circumstantial/ Contributory	
Cockpit Gradient	Flight hours	Log books record	Circumstantial	
3) Unsafe Supervision				
Lack of effective oversight by CAAN	Crew taking risk to complete flight in marginal weather condition	Interviews	Contributory	ATS Operation Manual of Pokhara not prepared
Lack of effective oversight by Operator	Failed to identify unsafe acts	Interviews/ CVR & FDR recordings	Circumstantial	• No reports on activation of EGPWS warnings • Entering IMC in VFR flight

	No CVR analysis on Pokhara Jomsom flight			No CVR downloading facility available for DHC-6/400
	Failure in monitoring SOP compliance by the crew			
Failed to identify documentation error by CAAN	Basis of RTOW calculation undetermined	SOP/ OM and AFM	None	Significant documentation deficiency (Use of 300 series documents for series 400)
4) Organizational Influences				
Lack of effective training for crew	Skilled based training on EGPWS	Training record	Contributory	Differential training only could not cover all the areas
	Confusion on interpretation of digital instrumentation	Interview	Circumstantial	
Operational Tempo	Get-There-Itis in tourist sectors	Interview Accident/incident records	Circumstantial	Maximum number for flights in Tourist sectors & accident/incident events also most frequent in these sectors.
Lack of risk management	SMS not implemented yet in Pokhara Aerodrome	Safety Oversight Inspection Report	Circumstantial	
Lack of supervision on OJT ATCs	ATC experience record	ATC duty roster	None	

2.12 Training and Company Procedure

Pilots Proficiency Checks (PPC) are conducted twice a year and Route checks are conducted once a year in addition to other mandatory trainings. Flight Simulator training of all flight crew of DHC-6 aircrafts are conducted in Frasca International Inc. flight simulator Device at Thai Airways, Bangkok, Thailand once a year for validation of instrument flying procedures. Captains of DHC-6 fleet are sent to flight safety International, Toronto, Canada once every two year for Twin otter Recurrent Pilot Course that includes ground training and flight training in DHC-6 type simulator. The flight simulator training includes exercises such as Unusual Attitude recovery, limited panel (climbing & descending) etc. besides other normal/non-normal procedures in accordance with FAA ATP standards. During course of investigation it was noted that though pilots were trained in escape maneuvers of WIND SHEAR however no training were done for TAWS (GPWS/EGPWS) escape maneuvers considering similarity in the corrective action. The F/O received his flight simulator training in Bangkok for instruments flying procedure and Captain had record of flight simulator trainings in both Bangkok and flight safety Canada.

Operation Manual of Tara Air Part-A on "New equipment Training Planning" states: "New equipment training for new equipment installation shall be carried out as per Training manual".

Company training program of Tara Air; chapter 10(a,b) includes classroom training on TCAS, EGPWS/GPWS, and WX Radar every 12 months for 1 hour, utilizing materials from aircraft Manual, SOP, Manufacturer's booklets, ICAO/COSCAP documents and related publications. Chapter 11(a, b) includes refresher/training on CFIT, ALAR and Runway incursion/excursion. The training program does not include simulator Pilot recurrent training of Twin Otter (DHC-6/400).

2.13 Sector Fuel

The normal fuel consumption rate of the aircraft was 600 pounds per hours. Estimated endurance remaining at the time of accident was 1 hours and 42 minutes; sufficient for the aircraft to fly to destination Jomsom and back to Pokhara but could be critical if decided to divert to Kathmandu where the airport was open for IFR operations only. The need to divert to Kathmandu would have arised if Pokhara airport was closed for any reason and the aircraft could not proceed to Bhairawaha due weather condition below minima.

Table 10: Estimated fuel on board.

Time UTC	Fuel On Board(lbs)
02:02Z	1200
02:15Z	1066
02:19Z	1014

Table 11: Approximate fuel requirements.

Airport	Total Distance (NM)	Time(HH:MM)	Estimated fuel burn (lbs)	Estimated Fuel Remaining (lbs)
Pokhara	59	00:30	300	714
Bhairahawa	110	00:55	550	464
Kathmandu(VFR)	138	01:09	690	324
Kathmandu(IFR)	138	01:25	850	164

3 CONCLUSION

3.1 Findings

1. The Crew were qualified and certified in accordance with the rules and the regulations of the CAAN.
2. Proficiency checks of the crew were carried out according to CAAN requirement and the captain was also a DCP for Tara Air.
3. Rest period and duty time of crew were within the acceptable guidelines.
4. The aircraft was operating within the performance limitation as per its Flight Manual. The weight and center of gravity were within the prescribed limits prior to the take-off at Pokhara.
5. No RAIM Prediction error was reported for the Pokhara Jomsom route.
6. The aircraft was maintained as per approved maintenance schedule. No maintenance work was overdue and all maintenance records were maintained properly.
7. Aircraft was equipped with latest avionics and there was no evidence of failure of the aircraft's flight controls, systems, structure, or power-plant prior to the impact. All the damages to the aircraft occurred after the accident.
8. Crews were found not complying with VFR flight rules as the crew repeatedly entered into the cloud during the flight.
9. The aircraft was completely destroyed due to the impact force and post impact fire.
10. The weather condition at the accident site was cloudy with wind direction/speed of 139^0/11kts at the time of the accident.
11. Skill based training on EGPWS escape maneuver was not sufficient.
12. METAR provided by DHM mentioned mist in the early morning and later Haze with 4 km visibility at the time of departure. However, Pokhara tower observed 5 km visibility using the same visibility check point chart and opened the aerodrome for VFR operation.
13. Prior to departure, Pohkara tower reported the weather of first alternate aerodrome Bhairawaha closed due to 1200m visibility.
14. After receiving the weather, the Captain had briefed the F/O that they would proceed until Tatopani and be back if the weather was not favourable.
15. The F/O was ‘Pilot Flying’ whereas the Captain was ‘Pilot Monitoring’.
16. Escape route is not defined for Pokhara-Jomsom. However, Jomsom-Pokhara is defined.

17. There is no provision for enroute weather information.
18. As per OM Part A, the second in command / F/O shall advise captain on all operational matter as asked by him and if in his opinion some item has been overlooked remind him and be prepared for the actions to be followed in an emergency. However, the copilot was not assertive during flight because of some kind of trepidation.
19. Lack of effective oversight was observed in the part of operator as well as regulator at the departing airport.
20. There was ambiguity while validating type certificate and approving training on different product of same type certificated aircraft.
21. The crew of the fateful flight were found to continue the flight even when the height of the aircraft was less than 1000ft below the terrain or heights or obstracles in VFR flight in contrary to provision set out in Part A of OM.
22. Crew were so occupied to avoid weather, they failed to notice their excessive deviation to the left of track and unabled to regain the track which is in contrary to provisions set in Part A of OM.
23. Despite of repeated EGPWS warnings, the decision of the crew to continue descend is contradictory. Subsequently, they also failed to demonstrate good recovery technique and the call out. However, there is no Mandatory Requirement for reporting EGPWS activation.
24. Crew did not report the correct position of the aircraft to ATC.
25. The Pokhara tower changed the runway in use during the taxi out without significant reason.
26. The interference of Radio Nepal transmission was observed in Pokhara tower VHF frequency 123.8 MHz leading to difficulty for two way communication.
27. ELT did not activate after the impact of aircraft with the terrain.
28. There was no response from INMCC Banglore despite several querries from RCC, TIA regarding ELT activation.
29. There is no SOP developed by NOC to keep fuel sample during refueling in Pokhara airport.

3.2 Contributing Factors

The contributing factors for the accident are:

1. Loss of situational awareness
2. Deteriorating condition of weather
3. Skill base error of the crew during critical phases of flight
4. Failure to utilize all available resources (CRM), especially insensitivity to EGPWS cautions/warnings

5. Reluctancy on the part of crew to follow VFR rule

3.3 Probable Cause

The Commission concludes that the probable cause of this accident was the fact that despite of unfavourable weather conditions, the crew's repeated decision to enter into cloud during VFR flight and their deviation from the normal track due to loss of situational awareness aggravated by spatial disorientation leading to CFIT accident.

4 Safety Recommendations

4.1 Interim Safety Recommendation

The Commission issued the following interim safety recommendation on 2072.12.21 BS:

"CAAN should immediately enforce the mechanism to stop the tendency of PIC acting as pilot monitoring and F/O acting as pilot flying under VFR flight in domestic sectors in some serious and critical circumstances (IMC Conditions, Terrian Warning, Traffic Collision Avoidance Warning, STALL Warning, Severe Turbulence and thunderstorm, low visibility and cloudy condition etc.) in enroute phase of the flight."

In order to prevent similar accidents in the future, the following recommendations are made by the Commission.

4.2 Tara Air Pvt. Ltd.

1. An effective operational control of the aircraft should be maintained even outside main operation base.
2. Adequate skill based training for the crew should be provided when new technology is introduced in the aircraft.
3. The operator should ensure compliance to the provisions of VFR flight stipulated in OM.
4. Not to make an attempt in marginal weather condition (with rain or moving cloud or haze) with low visibility and low cloud ceiling, the operator should review its operation manual accordingly.
5. The operator should devise some mechanism for enroute weather to ensure safe operation along the routes serving to remote airports.
6. ELT registration and other technical requirements like compass swing should be complied effectively while importing aircraft.

4.3 Civil Aviation Authority of Nepal (CAAN)

1. CAAN should reinforce and strengthen its safety oversight capability.
2. CAAN should facilitate and develop procedures relating to navigation and communication along the routes serving to remote airports.
3. CAAN should devise some mechanism for enroute weather to ensure safe operation along the routes serving to remote airports.
4. CAAN should implement Safety Management System in all airports.
5. ELT registration and other technical requirements like compass swing should be implemented effectively while importing aircraft.
6. The visibility observed by the ATC tower and reported from Met office using same visibility check point chart should be consistent.
7. CAAN supervision for training and documentation (differential training and validitation of type certificate etc.) should be improved.

8. Feasibility on the installation of an in-built antenna type ELT or any other alternate means along with standard antenna to facilitate timely search and rescue operation in Nepalese registered aircrafts should be studied.
9. CAAN should carry out study for gradually introducing some requirements for installation of suitable cockpit image recorders in the aircrafts equipped with FDR and CVR.
10. CAAN, in co ordination with operators should initiate for reviewing in the existing Flight Data Monitoring programs to ensure operating procedures applicable to enroute phase of STOL flight operations.

4.4 Ministry of Culture, Tourism and Civil Aviation

1. A permanent and separate Aircraft Accident Investigation Commission should be established under the Ministry of Culture, Tourism and Civil Aviation.
2. Sufficient resource (financial, personnel, technical) should be made available to the commission for its effective and timely investigation.
3. The Ministry should develop and adopt AIG procedure manual.
4. The Ministry should continuously monitor the activities of CAAN and airlines in order to augment the aviation safety in Nepal.
5. The Ministry should coordinate with the concerned meterological authorities to facilitate enroute weather information for STOL operation.

4.5 Department of Hydrology and Meteorology

1. DHM should develop and facilitate to provide enroute weather in various routes to STOL aerodrome.

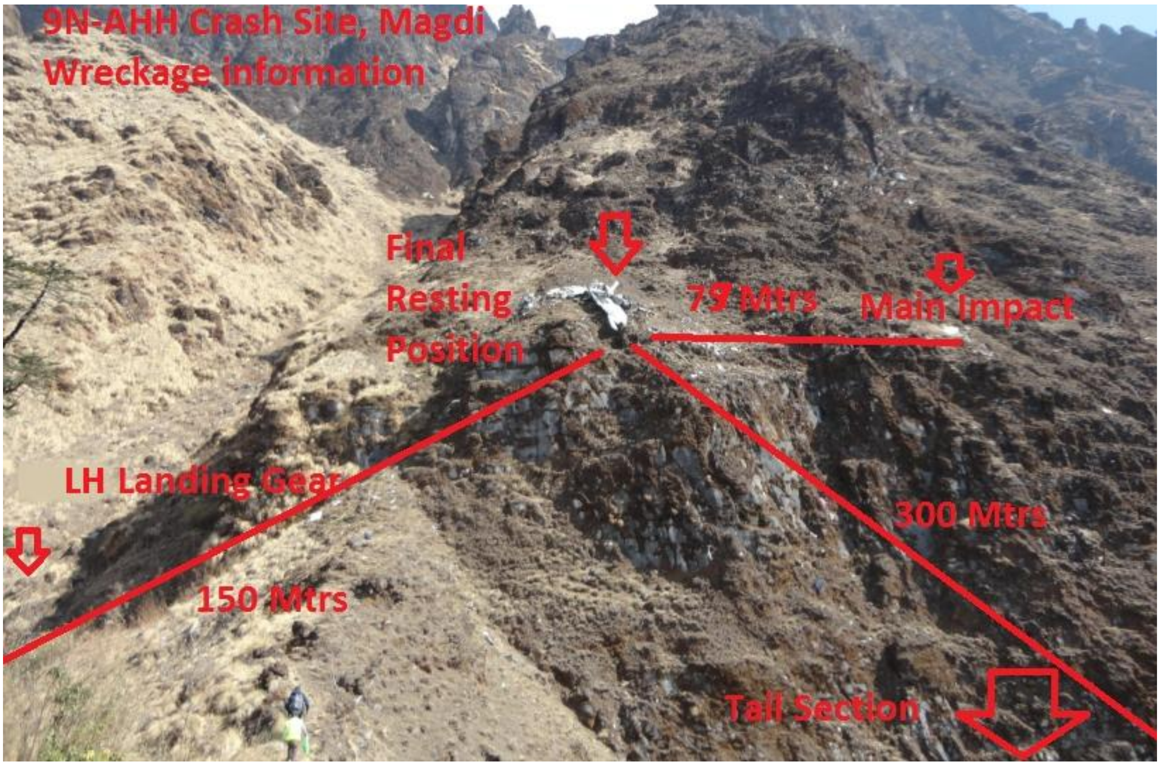
4.6 Nepal Oil Corporation

1. NOC should develop fuel collection and sampling system for all aircraft operated in Nepal.

Appendix-A: Damage to the Aircraft

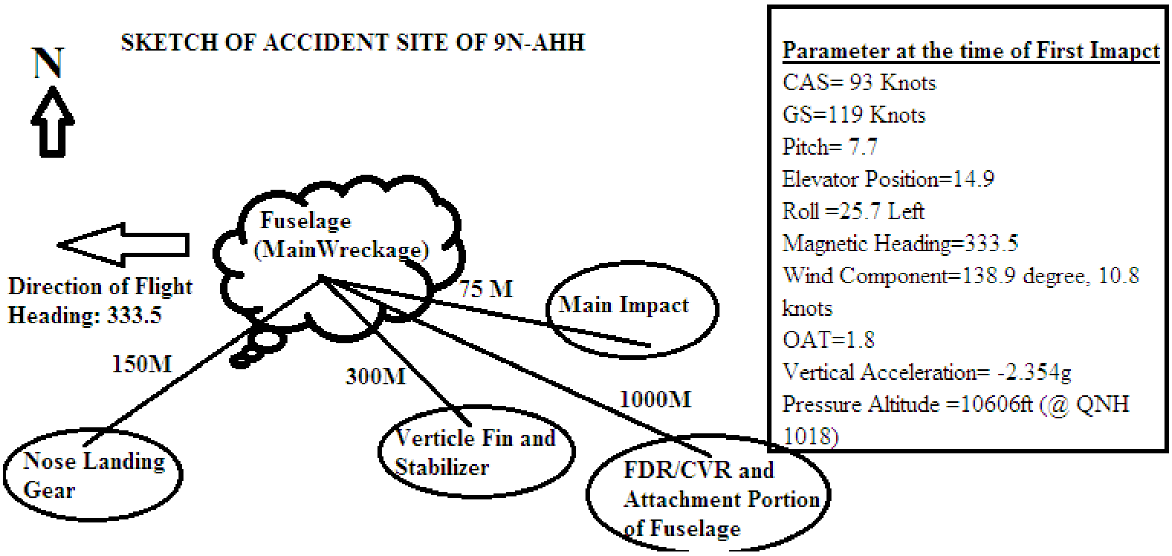
Note: Aircraft was completely damaged and main fuselage caught fire and remaining unburned wreckages were resting finally as shown in the photos.

Appendix-B: Wreckage Information



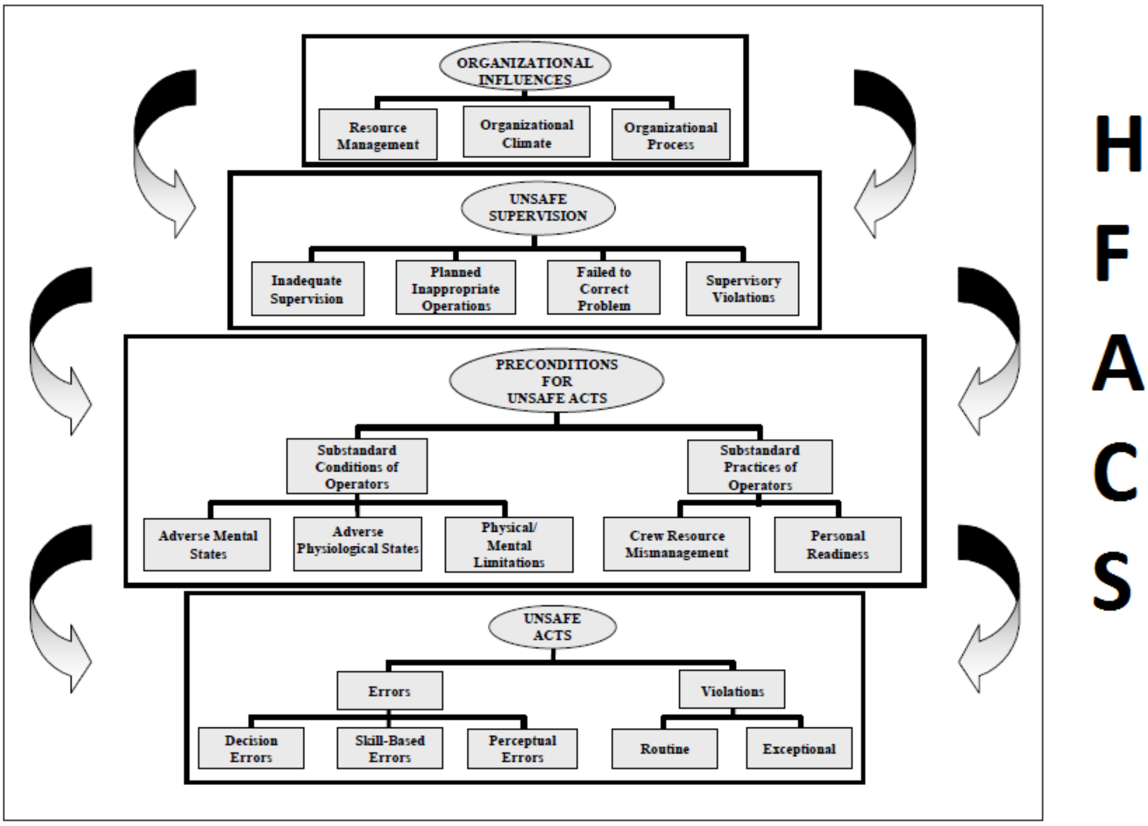
Wreckage Distribution

Empennage and CVR/FDR/ELT location


SKETCH OF ACCIDENT SITE OF 9N-AHH
N
Direction of Flight
Heading: 333.5
Fuselage
(MainWreckage)
75 M
Main Impact
150M
300M
1000M
Nose Landing
Gear
Verticle Fin and
Stabilizer
FDR/CVR and
Attachment Portion
of Fuselage
Parameter at the time of First Imapct
CAS= 93 Knots
GS=119 Knots
Pitch= 7.7
Elevator Position=14.9
Roll =25.7 Left
Magnetic Heading=333.5
Wind Component=138.9 degree, 10.8
knots
OAT=1.8
Vertical Acceleration= -2.354g
Pressure Altitude =10606ft (@ QNH
1018)

Appendix - C: Theoretical frame work of human factor analysis and classification systems

Human factors analysis and classification system (HFACS) has recently been developed to analyze human factor related accident. One particularly attractive approach to the beginning of human error is the one proposed by James Reason (1990). Generally referred to as the "Swiss cheese" model of human error, Reason describes four levels of human failure, each influencing the next. Following figure illustrate the four levels of failures from the human factor point of view and accident investigation commission has taken all necessary measure to study and find out the causes of such accident.



Overview of the Human Factors Analysis and Classification System (HFACS).

Four Level of HFACS

Working backwards in time from the accident, the first level depicts those unsafe acts of operators that ultimately led to the accident. More commonly referred to in aviation as aircrew/pilot error, this level is where most accident investigations have focused their efforts and consequently, where most causal factors are uncovered After all, it is typically the actions or inactions of aircrew that are directly linked to the accident. For instance, failing to properly scan the aircraft's instruments while in instrument meteorological conditions (IMC) or penetrating IMC when authorized only for visual meteorological conditions (VMC) may yield relatively immediate, and potentially grave, consequences. Represented as "holes" in the cheese, these active failures are typically the last unsafe acts committed by aircrew.

Decision making in an aeronautical environment involves any pertinent decision a pilot must make during the conduct of a flight. It includes both preflight go/no-go decisions as well as those made during the flight. In aeronautics, decision making is of particular importance because of the safety consequences of poor decisions. All decision alternatives entail some level of risk. The choice between alternatives is a tradeoff based on the expected results for each alternative and the risk of failure to achieve these results when adopting the selected alternative. The way risk is perceived and managed can limit some choices.

The first involves the condition of the aircrew as it affects performance. Referred to as Preconditions for unsafe acts, this level involves conditions such as mental fatigue and poor communication and coordination practices, often referred to as crew resource management (CRM). Not surprising, if fatigued aircrew fail to communicate and coordinate their activities with others in the cockpit or individuals external to the aircraft (e.g., air traffic control, maintenance, etc.), poor decisions are made and errors often result. In many instances, the breakdown in good CRM practices can be traced back to instances of unsafe supervision, the third level of human failure. Drawing upon Reason's (1990) concept of latent and active failures, HFACS describes four levels of failure: 1) Unsafe Acts, 2) Preconditions for Unsafe Acts, 3) Unsafe Supervision, and 4) Organizational Influences. A brief description of the major components and causal categories of this Tara Air accident has shown in appendix-C.

1) Unsafe Acts:

The unsafe acts of aircrew can be loosely classified into two categories: errors and violations (Reason, 1990). In general, errors represent the mental or physical activities of individuals that fail to achieve their intended outcome. Not surprising, given the fact that human beings by their very nature make errors, these unsafe acts dominate most accident databases. Violations, on the other hand, refer to the willful disregard for the rules and regulations that govern the safety of flight. The irritation of many organizations, the prediction and prevention of these appalling and purely "escapable" unsafe acts, continue to avoid managers and researchers alike.

Skill-based behavior within the context of aviation is best described as "stick-and rudder" and other basic flight skills that occur without significant conscious thought. As a result, these skill-based actions are particularly vulnerable to failures of attention and/or memory. In fact, attention failures have been linked to many skill-based errors such as the breakdown in visual scan patterns, task fixation, the inadvertent activation of controls, and the mis ordering of steps in a procedure, among others. Breakdown in visual scan Failed to prioritize attention inadvertent use of flight controls Omitted step in procedure Omitted checklist item Poor technique Over-controlled the aircraft.

Decision Errorsare improper procedure Misdiagnosed emergency Wrong response to emergency Exceeded ability inappropriate maneuver Poor decision. Perceptual Errors (due to) Misjudged are distance/altitude/airspeed spatial disorientation Visual illusion etc. Violation are failed to adhere to brief, failed to use the radar altimeter Flew an unauthorized approach Violated training rules Flew an overaggressive maneuver Failed to properly prepare for the flight Briefed unauthorized flight Not current/qualified for the mission Intentionally exceeded the limits of the aircraft Continued low-altitude flight in VMC Unauthorized low-altitude canyon running. Violations By definition, errors occur within the rules and regulations espoused by an organization; typically dominating most accident databases. In contrast, violations represent a willful disregard for the rules and regulations that govern safe flight and, fortunately, occur much less frequently since they often involve fatalities.

Perceptual errors are not unexpectedly, when one's perception of the world differs from reality, errors can, and often do, occur. Typically, perceptual errors occur when sensory input is degraded or "unusual," as is the case with visual illusions and spatial disorientation or when aircrew simply misjudges the aircraft's altitude, attitude, or airspeed. Visual illusions, for example, occur when the brain tries to "fill in the gaps" with what it feels belongs in a visually impoverished environment, like that seen at night or when flying in adverse weather. Likewise, spatial disorientation occurs when the vestibular system cannot resolve one's orientation in space and therefore makes a "prediction" — typically when visual (horizon) cues are absent at night or when flying in adverse weather. In either event, the unsuspecting individual often is left to make a decision that is based on faulty information and the potential for committing an error is elevated. In this case, pilot entered in to the IMC condition which was a kind of violation or unsafe act from the crew. Refer appendix C for complete human factor analysis.

2) Preconditions for Unsafe Acts:

Preconditions for unsafe acts of crew, the unsafe acts of pilots can be directly linked to nearly 80 % of all aviation accidents. However, simply focusing on unsafe acts is like focusing on a fever without understanding the underlying disease causing it. Thus, investigators must dig deeper into why the unsafe acts took place.Numerous substandard conditions of operators can, and do, lead to the commission of unsafe acts. Nevertheless, there were a number of things that commission highlighted as a precondition or contributory factors of human error, in appendix-C

3) Unsafe Supervision:

The role of any supervisor is to provide the opportunity to succeed. To do this, the supervisor, no matter at what level of operation, must provide guidance, training opportunities, leadership, and motivation, as well as the proper role model to be emulated. Unfortunately, this is not always the case. For example, it is not difficult to conceive of a situation where adequate crew resource management training was either not provided, or the opportunity to attend such training was not afforded to a particular aircrew member. Conceivably, aircrew coordination skills would be compromised and if the aircraft were put into an adverse situation (an emergency for instance), the risk of an error being committed would be exacerbated and the potential for an accident would increase markedly.

The failure to consistently correct or discipline inappropriate behavior certainly fosters an unsafe atmosphere and promotes the violation of rules. Aviation history is rich with by reports of aviators who tell hair-raising stories of their exploits and barnstorming low-level flights .While entertaining to some, they often serve to promulgate a perception of tolerance and "one-up-manship" until one day someone ties the low altitude flight record of ground-level! Indeed, the failure to report these unsafe tendencies and initiate corrective actions is yet another example of the failure to correct known problems. Unsafe supervision of Tara air are highlighted in appendix-C

4) Organizational Influences:

As noted previously, fallible decisions of upper-level management directly affect supervisory practices, as well as the conditions and actions of operators. Unfortunately, these organizational errors often go unnoticed by safety professionals, due in large part to the lack of a clear framework from which to investigate them. Generally speaking, the most elusive of latent failures revolve around issues related to resource management, organizational climate, and operational processes.

Unfortunately, not all organizations have these procedures nor do they engage in an active process of monitoring aircrew errors and human factor problems via anonymous reporting systems and safety audits. As such, supervisors and managers are often unaware of the problems before an accident occurs. Indeed, it has been said that "an accident is one incident to many" (Reinhart, 1996). It is incumbent upon any organization to fervently seek out the "holes in the cheese" and plug them up, before they create a window of opportunity for catastrophe to strike. Organization Influence can be subdivided in to resource management, organizational climate and organizational process. It is our belief that the Human Factors Analysis and Classification System (HFACS) framework bridges the gap between theory and practice by providing investigators with a comprehensive, user friendly tool for identifying and classifying the human causes of aviation accidents.

Appendix-D: Statement of Conformity (VIKING)

8

	Signature	AME or AMO/ACA

STATEMENT OF CONFORMITY

VIKING

(For a newly Manufactured Aircraft)

Aircraft

Manufacturer:	Model:	Serial Number:	Type Certificate:
Viking Air Limited	DHC-6 Series 400	926	A-82

Engines

Manufacturer:	Model:	Serial Number:	Type Certificate:
1. Pratt & Whitney Canada Corp.	PT6A-34	PCE-RB0889	E-6
2. Pratt & Whitney Canada Corp.	PT6A-34	PCE-RB0890	E-6

Propellers

Manufacturer:	Model:	Serial Number:	Type Certificate:
1. Hartzell Propeller Inc.	HC-B3T	BUA33276	P-49
2. Hartzell Propeller Inc.	HC-B3T	BUA33309	P-49

Certification Statement

This aircraft was satisfactorily test flown in accordance with the FTP-6-400 Production Flight Test Procedure:

Document Title:	Number:	Dated:
Production Flight Test Certificate	FTP-6-CERT	10-Aug-2015

I hereby certify that the aircraft described above, produced in accordance with the policies and procedures of the Viking Air Quality Manual (QM-001) under Transport Canada Certificate of Approval Number 22-80, conforms to its approved type design and is in a condition for safe operation.

Date: 13 AUG 2015 Signature: SCOTT VIGER / S. VIGER
(On Behalf of Viking Air Limited)

VERSATILITY THAT WORKS

Statement Of Conformity Rev D

Appendix-E: Certificates

1. Validation of Type Certificate (CAAN)

CIVIL AVIATION AUTHORITY OF NEPAL

VALIDATION OF

TYPE CERTIFICATE

Certificate No.:-144/2015

This Certificate, issued to Viking Air Limited, 1959 de Havilland Way, Sidney, British Columbia, Canada, V8L 5V5 certifies that the DHC-6 Series 400 (Twin Otter) the technical data and operating limitations for which are contained in Type Certificate Data Sheet No. A-82 issued by Transport Canada dated 24 June 2010 is of proper design, material, specification, construction and performance for safe operation and meets the minimum standards prescribed by the Director General of Civil Aviation Authority of Nepal in Nepalese Civil Airworthiness Requirements Chapter B.1.

This Certificate is of indefinite duration unless cancelled, suspended or revoked.

16th June 2015
Date of Issue

For Director General

2. Type Certificate (Transport Canada)

Transport Canada Transports Canada

Type Certificate

A-82

Pursuant to Canadian Aviation Regulations PART V, SUBPART 21, this Type Certificate is issued to:

Viking Air Limited
1959 de Havilland Way
Sidney, British Columbia
Canada, V8L 5V5

For the Following Aeronautical Product(s):

DHC-6 SERIES 1, 100, 110
DHC-6 SERIES 200, 210
DHC-6 SERIES 300, 310, 320
DHC-6 SERIES 400

Details of the type design, basis of certification, operating limitations and other associated airworthiness requirements are specified in:

Department of Transport Type Certificate Data Sheet A-82 Issue 13

or latest revision

Director, National Aircraft Certification
For Minister of Transport

June 24, 2010
Date of Issue

Canada

3. Certificate Of Registration (CAAN)

CIVIL AVIATION AUTHORITY OF NEPAL

Certificate of Registration

1. Nationality and Registration Marks	2. Manufacture and Manufacturer's Designation of aircraft	3. Aircraft Serial Number
9N-AHH	Viking Air Limited DHC-6-400	926

4. Name of owner: Aerostar Alpha Limited

5. Address of owner: Road Town, Tortola, British Virgin Island

6. Name of operator: Tara Air Pvt. Ltd

7. Address of operator: Kathmandu, Nepal

8. It is hereby certified that the above described aircraft has been duly entered on the register of Nepal in accordance with the Convention on International Civil Aviation dated 7 December 1944 and with the Civil Aviation Authority Act 1996 and rules made thereunder.

04/10/2015
Date of Issue

Signature

9. Transfer of ownership:

Note: This certificate is issued for registration purpose only and is not a certificate of title. The CAAN does not determine the right of ownership as between private persons.

4. Certificate of Airworthiness (CAAN)

CIVIL AVIATION AUTHORITY OF NEPAL

Certificate of Airworthiness

1. Nationality and Registration Marks	2. Manufacture and Manufacturer's Designation of aircraft	3. Aircraft Serial Number
9N-AHH	Viking Air Limited DHC-6-400	926

4. Categories Transport (Pax.)

8. This Certificate of Airworthiness issued pursuant to the Convention on International Civil Aviation dated 7 December 1944 and the Rules made under the Civil Aviation Authority Act 1996. This Certificate shall remain valid so long as the aircraft is maintained and operated in accordance with the relevant Rules and the pertinent operating limitations.

08/10/2015
Date of Issue

Signature

RENEWAL & EXTENSIONS

From	To	Signature	From	To	Signature
8/10/015	7/10/016				

Appendix F: TAWS OVERVIEW

The TAWS operates continually using GPS, altitude, temperature data, and database information to monitor aircraft position relative to surrounding terrain and known obstacles. If the aircraft flies into danger where a conflict with terrain or a known obstacle is imminent, the TAWS provide both visual and aural alerts and warnings to the pilot. The TAWS also provides alerts and warnings for excessive rates of descent and inadvertent descents or altitude loss after takeoff. The TAWS provides an aural altitude call--out when 500 feet above runway elevation during a landing approach and also monitors altimeter systems in the aircraft to provide alerts for possible altimeter malfunctions or errors.

The TAWS also provides low flap alerting as well as an excessive bank angle call--out, when configured.

Using global positioning system (GPS) information, from other Apex sensors, the TAWS determines present position, altitude, track, and groundspeed. With this information, the TAWS is able to calculate position of the aircraft relative to the terrain and advise the flight crew of a potential conflict with the terrain or obstacle. Aural and visual alerts are provided when terrain or obstacles may intrude upon computed envelope boundaries in the projected flight path of the aircraft.
Caution or warning alerts are provided visually and aurally and vary depending on the type of conflict. Terrain display is provided on the primary flight display (PFD).

The LH side of the instrument panel includes pilot PFD, the RH side of the airplane’s instrument panel included copilot PFD. The center instrument panel included upper MFD (situational awareness) and lower MFD (systems).

Appendix G: SYSTEM BENCH SIMULATION OF ACCIDENT FLIGHT PATH

SYSTEM BENCH SIMULATION OF ACCIDENT FLIGHT PATH

Tara Air DHC-6-400, 9N-AHH
Myagdi District, Nepal, 24-February, 2016
TSB File A16F0031
System Bench Simulation of Accident Flight Path
With and Without Synthetic Vision System (SVS) Displayed

On June 16, 2016, per a request of the Transportation Safety Board (TSB) of Canada, a bench simulation of the accident flight referenced above was performed on a Honeywell system's bench in Phoenix, AZ at 21111 N. 19th Ave, Phoenix, AZ 85027. Only Honeywell was in attendance during the simulation. Data for the simulation was provided to Honeywell by the TSB.

The objective of the simulation was to demonstrate the improvement in aircraft situational awareness between a cockpit with and without Honeywell's available Synthetic Vision System (SVS) functionality for the Apex system.

In order to closely replicate the flight path experienced by the flight crew in this particular accident, the supplied data was broken into 8 specific locations along the flight path. Those GPS locations and altitudes were manually entered into the Flight Management System (FMS) as waypoints. The data points chosen and converted to FMS waypoints were separated by approximately 1 mile each. An initial waypoint well ahead of the first provided data point, was established in order to allow the simulation to stabilize prior to reaching the first accident waypoint in the FMS flight plan. The simulation was allowed to run with the autopilot engaged along with lateral and vertical modes active. The autopilot was used to follow the lateral flight plan while the pitch knob on the Flight Controller panel was used to manually control pitch in an attempt to replicate the pitch and altitude values recorded in the EGPWS at the given GPS positions. The videos recorded on the system bench appear to very closely replicate the same flight path as depicted in the supplied data.

Figure 1 and **Figure 2** depict the FMS waypoints and flight plan manually entered into the system bench based on the data provided from the EGPWS. The waypoint P0001 was chosen to be at a specific position to allow the simulation to stabilize well prior to the first data point at waypoint P0012. In addition, the altitude of P0001 was chosen to be the same as P0012 because the flight path and descent rates prior to P0012 were not known and not given in the data provided.

Appendix A contains a table of the data provided. The lines highlighted in yellow are the data points used as input to the FMS flight plan. See also the included electronic file with this report titled "Data for Simulation.xlsx".

Two simulated flights were performed on the system bench using the above setup and procedure. During the two simulated flights, separate video cameras were placed in front of the pilot's and copilot's PFDs. The SVS functionality was enabled (displayed) on the pilot's side PFD while the F/O's side had the SVS functionality disabled (not displayed). In this manor, a side by side comparison of the two PFDs can be made by playing back the videos at the same time. For the first simulated flight, the video captures the entire PFD display including the engine instruments and radios. For the second simulated flight, the video has been zoomed in to only include the ADI/HSI portions of the display which includes the SVS and terrain.

In addition to video, still images were taken at various locations along the simulated flight path. This was achieved by the following procedure:

1. The simulation was run until a particular waypoint was reached (example: waypoint P0006) in order to establish the correct GPS position and SVS viewing direction.

2. The computer driving the simulation was "paused" and then disconnected from the avionic's ASCB bus.
3. The simulation operator, utilizing a tool called the "TIU", manually entered values for altitude, pitch, roll, and airspeed. The values chosen were those provided by the EGPWS data. For example, for waypoint P0006, this was data point time = 2:18:35.00.

- Pitch = 6.2 degrees (up)
- Roll = 9.8 degrees (right wing down)
- Altitude = 9961.5 ft (baro altitude)
- Airspeed = 130 knots (calibrated airspeed)

By using the above method for each waypoint chosen, the operator could be sure that the position, orientation, and viewing angle of the aircraft in the simulation as closely matched the provided data as was possible as well as closely matching the likely orientation of the aircraft during the accident flight.

- **Figure 3** shows an image of the pilot's PFD at waypoint **P0012** with the SVS enabled (displayed).
- **Figure 4** shows an image of the F/O's PFD at waypoint **P0012** with the SVS disabled (not displayed).
- **Figure 5** shows an image of the pilot's PFD at waypoint **P0004** with the SVS enabled (displayed).
- **Figure 6** shows an image of the F/O's PFD at waypoint **P0004** with the SVS disabled (not displayed).
- **Figure 7** shows an image of the pilot's PFD at waypoint **P0006** with the SVS enabled (displayed).
- **Figure 8** shows an image of the F/O's PFD at waypoint **P0006** with the SVS disabled (not displayed). Electronic files of the videos and photos captured during the simulation have been provided on a disk with this report.

Special Notes

The viewer should keep in mind that since this is a simulation, engine and radio functionality was not included into this simulation. In addition, there may be other functionality on the displays (EGPWS alerts, miscompares, etc) that may be presented which do not intend to replicate the accident flight. Furthermore, the EGPWS was not functional in the simulation so no alerts are provided and there may be some depictions of an EGPWS failure that do not represent the accident flight. Due to limitations in the simulation, some of these anomalies could not be avoided. While some portions of the display may not exactly replicate the accident flight, the view of the synthetic vision with terrain is as close as could be achieved to the accident flight. In addition, the initial starting point of the simulated flight is physically located within an adjacent mountain (only achievable in a simulation). As the aircraft moves during the simulation, at approximately 1 minute and 10 seconds into the simulated flight, the aircraft moves out of the adjacent mountain and the simulated accident flight begins. Due to the fact that the accident team does not know the position of the aircraft prior to the data provided (which starts at waypoint P0012), then only once the aircraft reaches the waypoint P0012 can we say we are at a point that closely matches the accident flight. As described above, the simulation's flight prior to P0012 was arbitrarily chosen in order to allow the system bench and SVS to stabilize prior to reaching waypoint P0012.

Apex 12, Viking Software Build 4.4 was used for this simulation. This software build has SVS functionality incorporated into the design. As such, the ADI and HSI areas of the PFD have been melded into one complete image covering 2/3rds of the display screen. Even with the SVS image turned off, the ADI/HSI are still one complete window covering 2/3rds of the display. The older version of the Apex software which does not contain SVS functionality has the ADI and HIS broken into two separate windows each covering 1/3rd of the display. Therefore, although the SVS is turned off in each of the simulated videos and photos on the F/Os side, the image captured on the F/O's side with the SVS turned off is not exactly how it would have looked in the accident aircraft which did not have SVS functionality software. The accident aircraft would have had the separate ADI and HSI windows with the blue over brown horizon encompassing only the upper 1/3rd of the display. It should be noted that the colors in the SVS images of the terrain are slightly darker than what was actually displayed during the simulation. The actual terrain image on the displays during the simulation was easier to distinguish peaks and valleys than what is represented in the video and images captured. Due to a limitation in the camera being used, the darker looking terrain in the images could not be avoided.

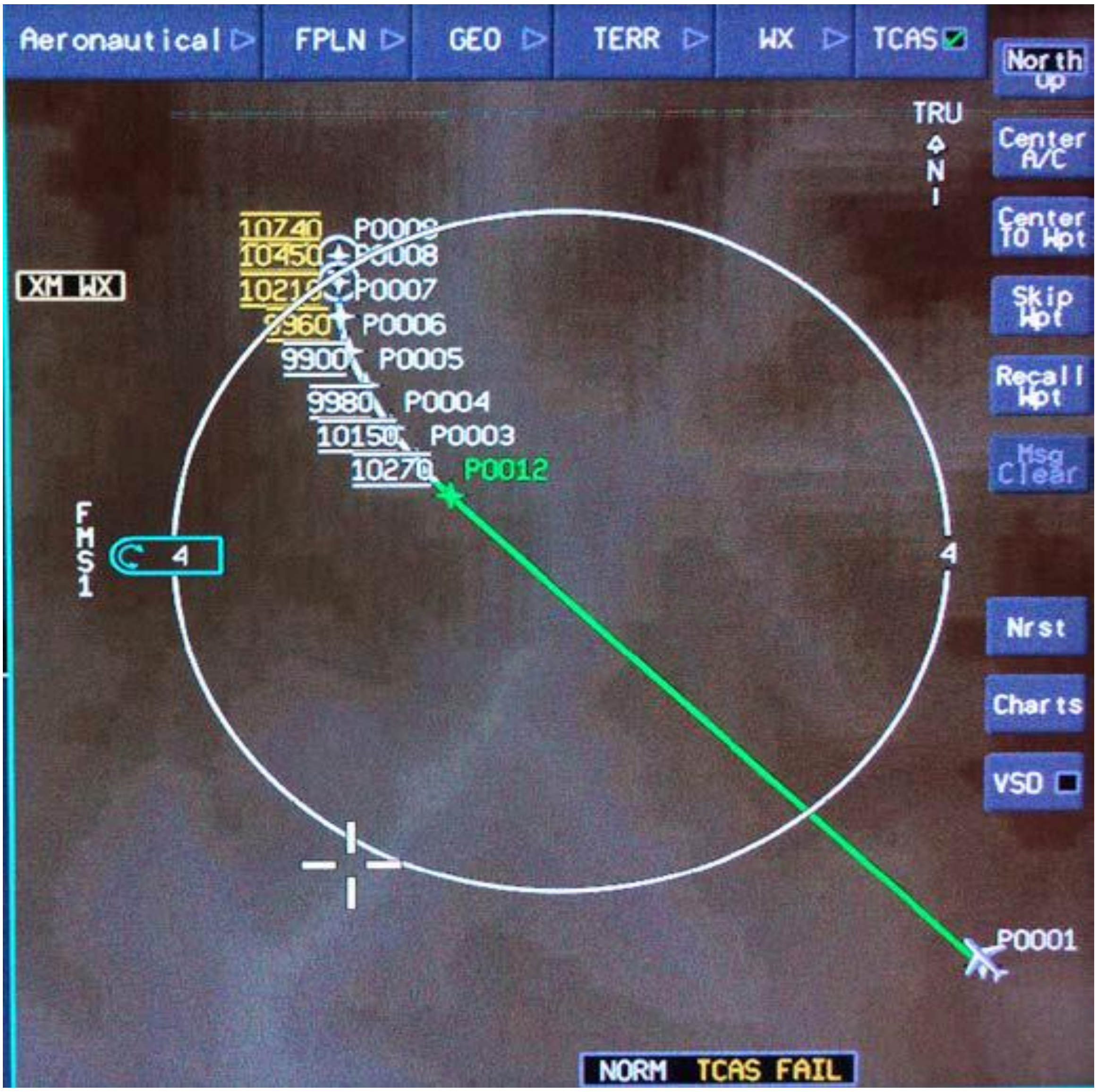


Figure 1. FMS Flight Plan Based on Data Provided

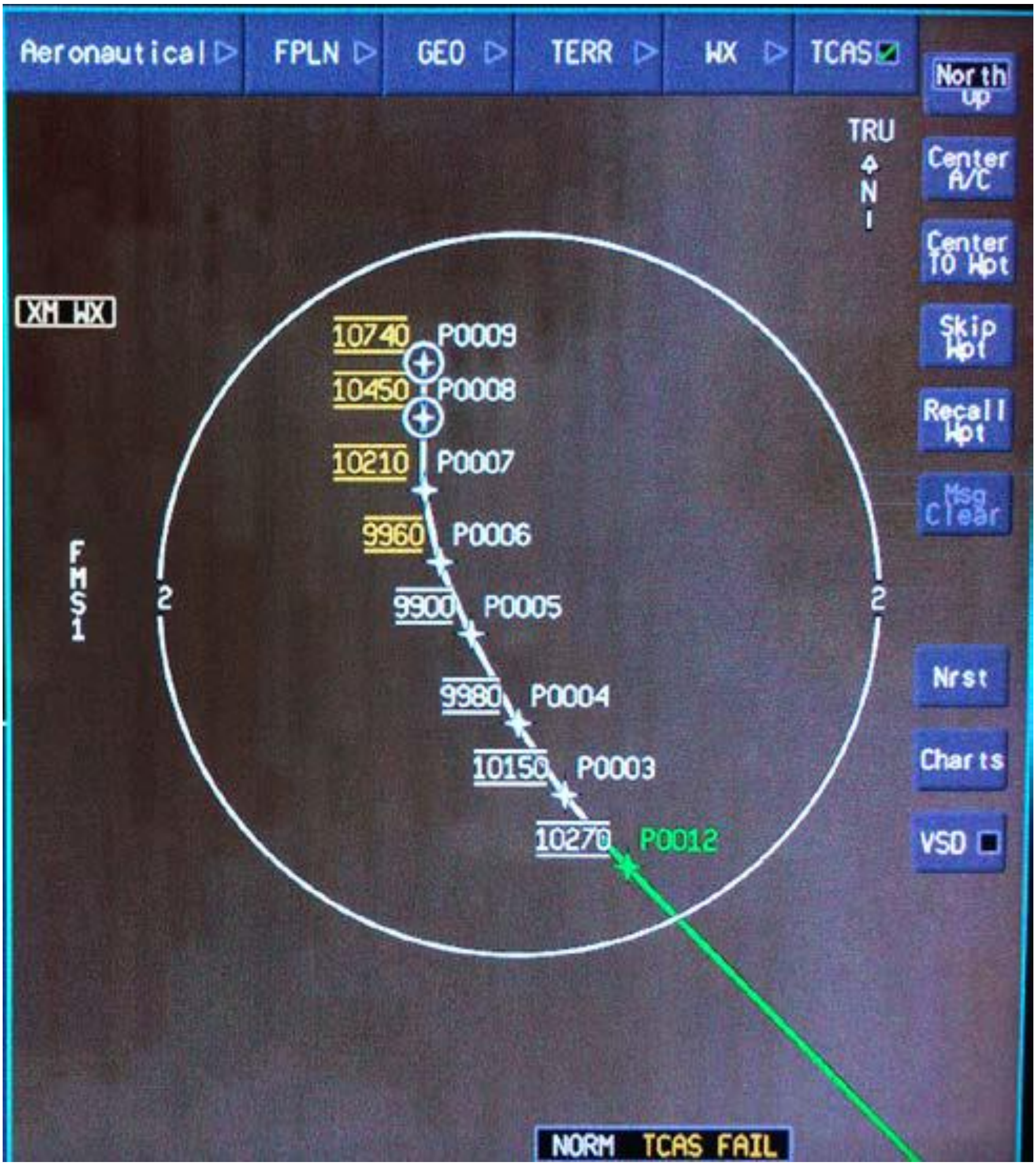


Figure 2. FMS Flight Plan/Waypoints Based on Data Provided

Figure 3. Pilot's Side Display With SVS Enabled at Waypoint P0012

Figure 4. F/O's Side Display Without SVS Enabled at Waypoint P0012

Figure 5. Pilot’s Side Display With SVS Enabled at Waypoint P0004

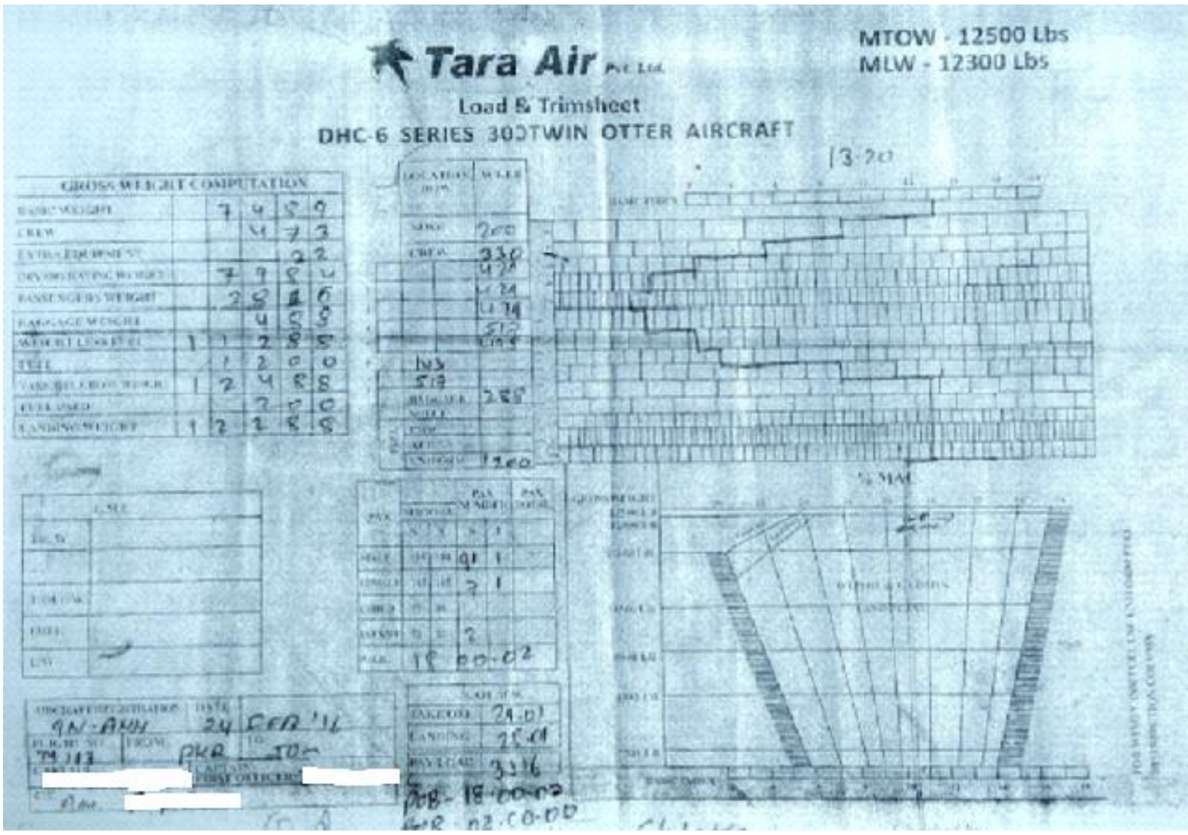
Figure 6. F/O's Side Display Without SVS Enabled at Waypoint P0004

Figure 7. Pilot’s Side Display With SVS Enabled at Waypoint P0006

Figure 8. F/O's Side Display Without SVS Enabled at Waypoint P0006

Appendix H: Weight and Balance

1. Load and Trim Sheets



2. Passenger Manifesto

		Passenger							Booking						Advanced Passenger Information				
		Lastname	Middlename	Firstname	Title	Type	Sex	Weight	Reference	Agency	Sta	Lang	Birthdate	Nat	Doc	Number	Issuedate	Expirydate	Place of Birth
− PKR		20																	
− PKR - JOM		20																	
− Y		20																	
	001	AHAMAD AA		RALRASHED	MR	ADULT	M	75.0	A17KEG	TOKTRUSD	OK	EN		KW	P	002581657			
	002	BABY		INFANT	MISS	INF	F	10.0	A17KLB	TPKR	OK	EN							
	003	BARAL	PRASAD	REBATI	MR	ADULT	M	75.0	A17KH7	TPKR	OK	EN		NP	I	CTZ 19793 KASKI			pkr 7
	004	BASTOLA		MUKTINATH	MR	ADULT	M	75.0	A17KE4	TPKR	OK	EN		NP	I	CTZ 1 145 KASKI			
	005	BHATTACHAN		BINATA	MISS	ADULT	F	65.0	A17KDN	TPKR	OK	EN		NP	I	MOB-9846101177			jomsom 5
	006	BHATTACHAN		KRISHNLAL	MR	ADULT	M	75.0	A17L3Z	TPKR	OK	EN		NP	I	MOB-9847711022			mustang
	007	GAUCHAN		DILKUMARI	MISS	ADULT	F	65.0	A17KDN	TPKR	OK	EN		NP	I	MOB-9846101177			lete 5 mustang
	008	GURUNG		DEVI JANG	MR	ADULT	M	75.0	A17KO9	TJUMBO	OK	EN		NP	I	CTZ 9107 LAMJUNG			
	009	GURUNG		FHENJOCK	MR	ADULT	M	75.0	A17KLC	TPKR	OK	EN		NP	I	MOB-9867700564			phalyak mustang
	010	HIRACHAN	PRASAD	LAXMI	MR	ADULT	M	75.0	A17L47	TPKR	OK	EN		NP	I	MOB-9846036212			marpha 3
	011	INFANT		BABY	MR	INF	M	10.0	A17KDN	TPKR	OK	EN							
	012	KC		MOTI BDR	MR	ADULT	M	75.0	A17KQ3	TPKR	OK	EN		NP	I	CTZ 67219 SHYANGJA			syangja 7
	013	KC		PABITRA	MISS	ADULT	F	65.0	A17KQ3	TPKR	OK	EN		NP	I	CTZ 421003 95260			syangja 7
	014	LAMA		LEPSANG	MRS	ADULT	F	65.0	A17KEO	TOKTR	OK	EN		NP	I	CTZ 5731			helambu sindupalchok
	015	NIURE		BALKRISHNA	MR	ADULT	M	75.0	A17KM9	TPKR	OK	EN		NP	I	CTZ- 503003 246			baglung palakot
	016	PARYER		KANCHA	MR	ADULT	M	75.0	A17L46	TPKR	OK	EN		NP	I	MOB-9847682144			syang
	017	SHERPA		DOLMA TSHIRING	MRS	ADULT	F	65.0	A17KF4	TOKTR	OK	EN		NP	I	CTZ 84586 SINDU			sindu palchok
	018	TAMANG		RAJKUMAR	MR	ADULT	M	75.0	A17KDQ	TPKR	OK	EN		NP	I	208819 ARMY			
	019	THAKALI		KAMALA	MISS	ADULT	F	65.0	A17KLB	TPKR	OK	EN		NP	I	CTZ-31706			mustang
	020	YING		MAK SIU	MISS	ADULT	F	65.0	A17KNN	TJUMBOUSD	OK	EN		CN	P	K036359770			china

Appendix I: Transcript of Flight Recorders

1. ATC Transcript

Time	Voice	Description
0:54	Fire Vehicle	Fire medium foam tender Good Morning
	TWR	Medium foam tender, tower good morning go ahead
	Fire Vehicle	RWY condition normal VHF test 12345,54321, how do you read me?
	TWR	Read you 5, how do you read?
	Fire Vehicle	5
1:11	AFQ	Pokhara, 9-FQ
	TWR	9 FQ, Pokhara, go ahead
	AFQ	Yes mam, can you say weather condition?
1:12	TWR	FQ, Airport open for VFR on sector, visibility towards south 5 Km, rest side 3000m
	AFQ	Roger, and very good morning to you.
	TWR	Good morning
1:55	AHH (FO)	Pokhara, 9HH
	TWR	9HH, Pokhara go ahead
	AHH	Morning mam, request start up for Jomsom latest jomsom
	TWR	9HH
	F/O	and Bhairahawa status
	TWR	9HH, good morning, copy Jomsom latest wind-clam visibility 8Km towards Lette, Kagbeni side 10Km, Lette foothill pass partially visible, few at 30000 feet.
	F/O	Copy that mam. Request QNH & temperature
	TWR	QNH Pokhara 1018, temp 15
	F/O	1018, 15. request startup for Jomsom
	TWR	9HH, runway 04, wind 270/3 kts, startup approved for Jomsom
	F/O	Startup approved for Jomsom, HH
1:56	TWR	9HH, Bhairahawa ariport closed, visibility 1200m,
	F/O	Ok, copied HH
1:59	Capt	Pokhara, HH, request taxi
	TWR	9HH, runway charged to runway 22, taxi via taxiway B, line up runway 22, report ready
	F/O	Taxi via B to runway 22, HH
2:00	TWR	9HH, leave control zero climbing to 10500 ft for Jomsom
	F/O	Leave control zone climbing to 500 ft for Jomsom
2:02	TWR	9HH, requesting POB
	F/O	stand by
	TWR	….
	F/O	Pokhara tower HH with POB 180002, foreigner 02
2:03	Capt	Pokhara, HH is ready and good morning mam
	TWR	9HH good morning sir, report 5miles west, runway 22, clear for take-off, right turn
	Capt	clear for takeoff, call you 5 miles west, right turn, HH

2:07	Capt	Pokhara, HH is 5 miles out of 6200, we estimate….. 26 will be estimate Jomsom
	TWR	Report Ghodepani
	Capt	Call you Ghodepani
2:08	Ultralight (IL)	HH, IL (HH doesnot respond)
2:08	Ultralight (IL)	HH, IL
	Capt	Go ahead sir
	IL	If possible, request on top level and mountain visibility, sir
	Capt	we are passing through 7000 now, light haze, mountain चाहिँ अलिकति visual भा छैन तर ground चाहि contact छ
	IL	Information copied, happy landing
	Capt	Ok
2:14	Capt	Pokhara, HH we are checking Ghorepani 10500
	TWR	9HH, contact Jomsom information
	Capt	122.5 see you back mam
	TWR	see you sir
2:18	ultralight (KN)	Pokhara, 9AKN, good morning and request engine start up for 30 min flight
2:19	TWR	Pokhara 9KN
	TWR	9KN, Pokhara, go ahead
	KN	Mam 9KN, requesting engine start up for 30 mins flight
	TWR	9KN, Rwy 04 wind 270/light QNH 1018 time check 0219 startup approved
	KN	QNH 1018, startup approved for 30 min flight
	KN	Pokhara tower 9KN request taxi
	TWR	9KN, taxi via taxi…… taxiway Brar…..Alpha, lineup runway 04 report ready
2:21	KN	Pokhara tower, 9KN, how do you read me ?
	TWR	9KN, read you 5. How do you read?
	KN	read you 5, 9KN
2:22	TWR	9KN, report inbound from Fewa, runway 04, cleared for take-off
	KN	report inbound from Fewa, runway 04, cleared for take-off
2:23	TWR	9KN, Pokhara
	KN	….. KN go ahead
	TWR	confirm 15 min flight
	KN	approximate 30 min flight
	TWR	copied, report inbound from 7DME
	KN	copied, --- 9KN
2:24	KN	Pokhara tower, 9KN, request proceed to ARBA area
	TWR	Roger, 9KN via ARBA approved
	KN	Approved from via ARBA, 9KN
2:28	TWR	9HH, Pokhara (sound)
		9HH, Pokhara (sound)

		9HH, Pokhara (sound)
2:28	TWR	------ 9HH, Pokhara
	TWR	9HH, Pokhara
2:29	TWR	9HH, Pokhara ………… भन्दीनुन ………………..
	(Another voice)	……………….. 9HH Pokhara ………..
		HH, Pokhara ……….
		9KN, Pokhara
	KN	Roger mam, 9KN, go ahead
	TWR	can you raise the call HH ?
	KN	…………..
	TWR	Roger … and Pokhara…. Visibility … 5Km ….(phone rining in background)
	KN	HH, KN
		HH, KN
		HH, KN
2:31	KN	HH, KN
	TWR	….. 9HH, Pokhara
2:32	KN	HH, KN
2:33	KN	HH, KN
2:34	TWR	9HH, Pokhara………
	(Another voice)	9HH, Pokhara………
		9HH, Pokhara………
	KN	9HH, KN
2:38	TWR	9HH, Pokhara
		9HH, Pokhara
2:39	KN	9HH, KN
2:40	TWR	9HH, Pokhara
		9HH, Pokhara
	KN	Pokhara TWR, 9KN, 300 kts and request descend to FEWA 4000
	TWR	9KN, descend 4000 request, report FEWA
	KN	Descend 4000 request, approaching at FEWA
	TWR	Roger
2:47	KN	Pokhara, 9KN, wer are ----- request 22
	TWR	Roger 9KN, join rt. Base, runway 22, report joining
	KN	Join rt. Base, report on joining
2:49	KN	Pokhara, TWR, 9KN, turning final, 22
	TWR	9KN, continue approach
	KN	continue approach, 9KN
2:50	TWR	9KN, 12…. 180/03 kts runway 22 cleard to land (voices in TWR on backbround)
	KN	Runway 22, cleaned to land
2:54	TWR	9…… (voice in TWR)
	(s)	9HH, Pokhara

		9HH, Pokhara
		9HH, Pokhara, do you read me?
2:56		.. . . ………….
		.. . . ………….
3:03	Y673	Pokhara TWR

2. CVR Transcript

Time	Voice	Description
4:25		(Check seem to be started at cockpit.)
5:13	Capt (A/H लाई)	न्याप्कीनहरु पर्दैन है
5:17	A/H	बिरामी छ रे, हई एक जना
	Capt	हो
Check continues		
6:25	Capt	Startup माग है
6:52	F/O	(Initiates call to Pokhara tower), Pokhara tower, 9HH
	ATC	9HH, Pokhara, go ahead
	F/O	Morning mam, request start up for Jomsom, latest Jomsom and Bhairahawa status?
7:06	ATC	9HH, good morning. Copy Jomsom latest wind-clam, visibility 8 Km towards Lette, Kagbeni side 10 Km Lette foothill parsie …..partially visible, few at 3000 feet
	F/O	copied that mam. Request QNH and temperature
	ATC	QNH Pokhara 1018, temperature 15.
	F/O	1018, 15 request start up for Jomsom.
7:36	ATC	9HH, runway 04, wind 270/3 ……, strartup approved for Jomsom.
	F/O	start up approved for Jomsom
7:50	Capt	Check 1,2……. Plus audio
8:06	F/O	जोमसोम 8Km छ है
	Capt	ल ल
	F/O	कागबेनीबाट 10 Km छ, लेतेबाट ३००० भि..भि भिजिविलिटी
8:13	Capt	हेरौ न, भएन भने फर्केर आउला के छ ….
		(Before start chekcs)
8:27	ATC	9HH, Bhairahawa airport closed, visibility 1200 m, mist.
	F/O	OK, copied HH
		(Check continues…….)
9:30	Capt	Ok you can start number two.
	F/O	Number 2
10:28	Capt	Ok, starting left
10:43	A/H	(Report PoB) 18 double….. (not clear ….)
	Capt	Roger
		(After start checks…..)
11:18	Capt	Pokhara, HH request take
	ATC	9HH, Runway changed to runwar 22, taxi via taxi way B, line up runway 22, report ready.

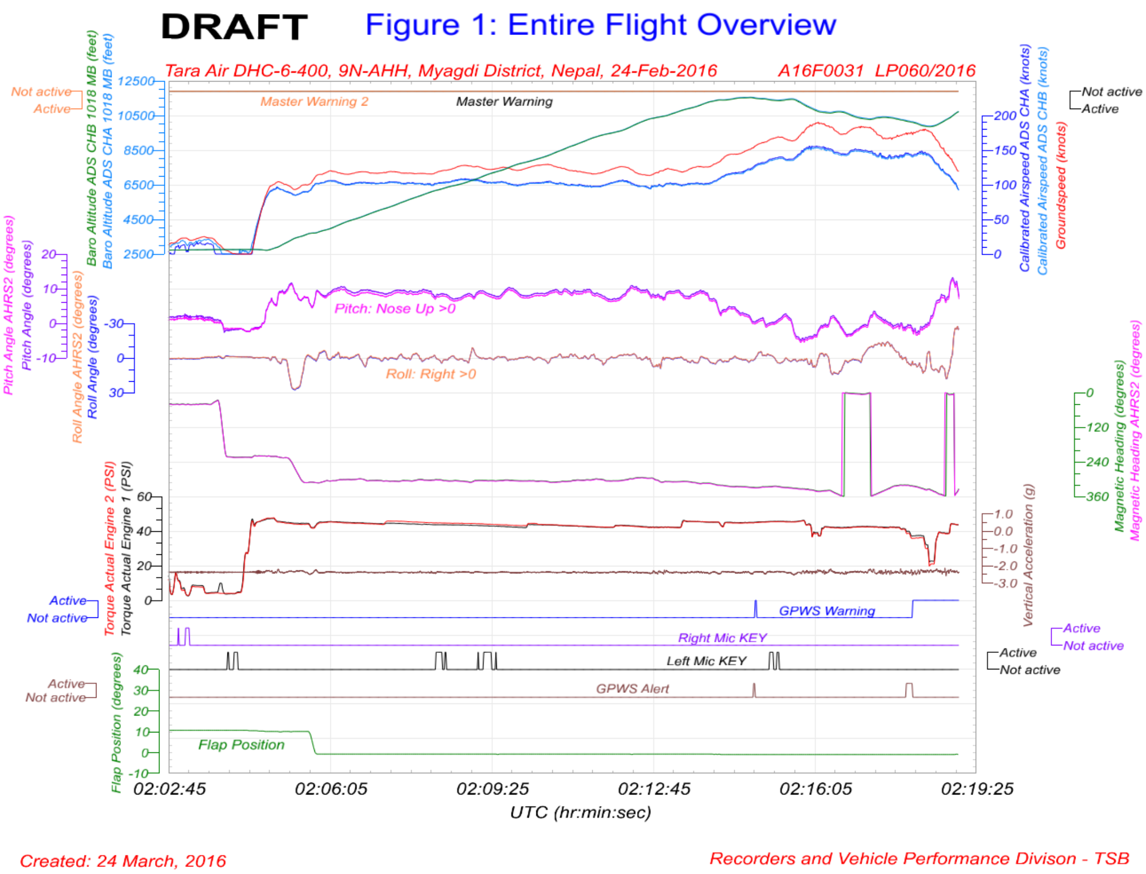
	F/O	Taxi via B to runway 22, HH
	Capt	Ok
11:35	Capt	Ok, right clear, left clear है
	F/O	Right clear sir.
		(Taxi started..)
		Some test….. Carried out before take off checklist
12:08	ATC	9HH, leave control zone climbing to 10500 for Jomsom
	F/O	Leave control zone climb to 10500 feet for Jomsom/NAV select ….. Selected
	Catp	NAV select…..
	F/O	selected
	F/O	Weather rader
	Capt	Put it on standby
13:18	F/O	Take off briefing?
	Capt	Ok, your takeoff my landing, rest standard and take off and take off weight is 124 eighteen है
	F/O	Flap 10, rotate at 70, climb 80 knots, after take off right turn.
	Capt	Roger, roger
13:42	Capt	Ok, first day of flight ….. Almost all completed except reverse है….. Reserve and beta annunciator
	Capt	Ok, both checked
	ATC	9HH, requesting PoB
	F/O	Stand by
14:18	F/O	Pokhara tower, HH with PoB 1802, foreigner 02.
	ATC	Copied
14:37	Capt	एकदम नराम्रो छ है यो त । खै के हिसाब गर्छन, ०२२ भन्छन
14:59	Capt	Ok, you have control है
	F/O	I have control
	Capt	liningup, ok you have control.
15:13	Capt	Pokhara HH, ready and good morning mam.
	ATC	9HH good morning sir, report 5 miles west, runway 22, clear for takeoff, right turn.
	Capt	Clear for takeoff, call you 5 miles west, right turn HH.
	F/O	Cabin secured
	Capt	Ok, strobe light on, landing lights on, cabin is clear ok all set.
	(Capt/F/O together)	1001…..1005.
	Capt	Now start…. Ok 40… take off power set, friction tighteened, speed pulling up above 55.
	F/O	Roger sir
15:53	Capt	70, ok 74… Rotate
16:18	Capt	You can turn, turn गर न …. Go to heading 305, 30 मात्र राखे हुन्छ… ३०भन्दा बढि नराख
16:50	Capt	Normal climg गर
17:18	Capt	हिजो भन्दा राम्रो रैछ आज त ….. यो त Light Haze मात्र हो ….. Cloud छैन यसमा

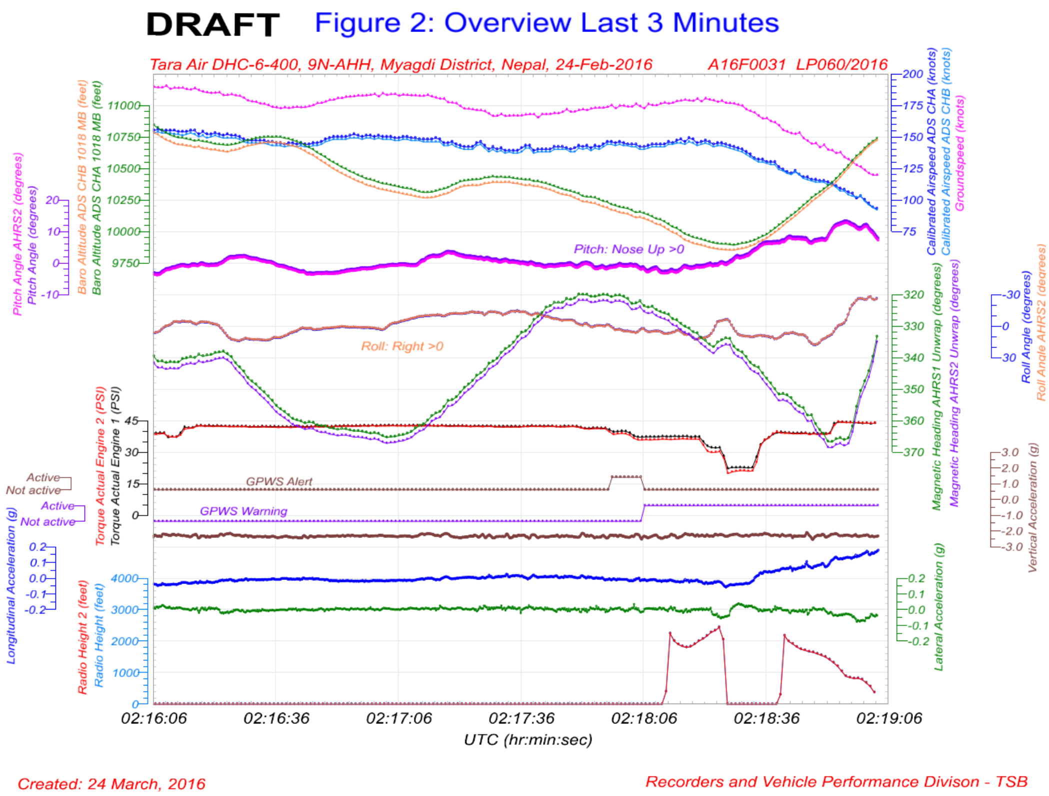
17:28	Capt	We are कति 4200 …. Victor mike
17:45	F/O	Ok, after take off checklist
	Capt	After take off checklist completed है त on TCAS, departed time अँ …. कति ? 05
19:25	Capt to ATC	Pokhara, HH is …… 5 miles out of 6200, we estimate…. 26 will be estimate Jomsom.
	ATC	Report Ghodepani
	Capt	Call you Godepani
19:45		(Music starts to play in background)
19:53	IL (from Pokhara ground)	HH….IL, (HH donot respond)
		Music continues……
20:12	Capt	हिजो जस्तो …. मा यो
20:18		IL = HH ………….. IL - If ………..
		Request on top level and visibility, Sir!
	Capt	We are passing through 7000 now, light haze, mountain चाहि अलि कति visual मा छैन तर ground चाहि contact मा छ ।
	IL	Coperd, thank you, happy landing.
21:23	Capt	हिजो भन्दा Cloud को base चाहि …. अलि माथि रैछ ।
22:21	Capt	105 मा ontop भएन भने 125 जाउ है ।
23:07		Beep comes
	Capt	Ok, 12 जाउ
23:33	Capt	Cell हरु रैछ ।
	F/O	(Briefly) हो
23:00	Capt	You are still 5 miles to Ghodepani
	Capt	continue climb गरेको गरै गर है
	F/O	हस
23:47	Capt	तातोपानी सम्म गएर हेर्ने अनि भएन भने चैने we will decide है । whether to continue or not भनेर …… देखेन भने ….
23:59	Capt	Ok, we left the 115 ……. 125
24:38:00	Capt	too low छ हेर्दा खेरी …… हेरौ?
24:42:00	Capt	घो….. घोडेपानीको range आयो है अब
24:57:00	F/O	Cloudy नै छ ।
	Capt	अँ ……. एकचोटी हेरौ न, यस्को माथि त हुदैन जस्तो छ हेर त, In between layer भएर जाउ न । …… यति नै
25:20:00	Capt	Ok, cruise power है
	F/O	Ok sir!
	Capt	Incase of diversion, it will be from left ……. Left hand है
25:27:00	F/O	Roger sir!
25:35:00	Capt	Ok, घोडेपानी त्यहा छ । यहाँ छ हैन घोडेपानी ? तिम्रो साइड तिर? ….. Rain हो की के हो ?
25:41:00		Beep
25:43:00	Capt	Ok
25:44:00	F/O	(in panic, but feebly) visual छैन सर
25:47:00	Capt	हँ……..

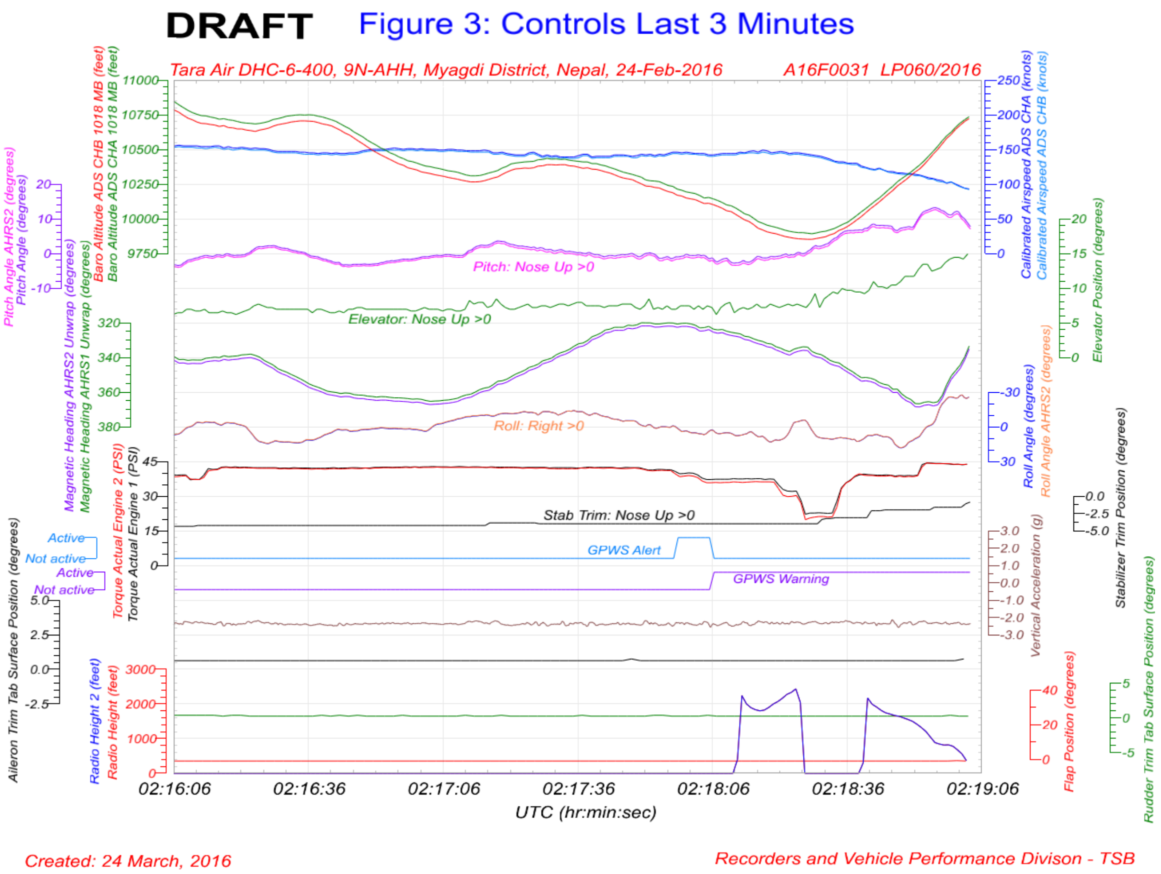
	F/O	Visual चाही छैन
	Capt	छैन ?
	F/O	Visual ,
	Capt, F/O	Visual..Visual छैन
	Capt	त्यही भएर एकचोटी हेरेर त्यसपछि we will decide भनेको
26:00:00		Terrain, Terrain
26:02:00	Capt	Ok, Ok we will be a visual….
		"Pull Up"
	Capt	हई……छ? छैन है ?
26:06:00	F/O	छैन सर
	Capt	Ok, what we will do is …… continue in this ………….हई
26:11:00	Capt	Ok, visual now
26:15:00	Capt	Ok, visual look at my side है
	F/O	हस
26:19:00	Capt	Pokhara, HH, we are checking Ghodepani, 10500.
	ATC	9HH, contact Jomsom information 122.5
	Capt	122.5, see you back mam!
	ATC	Ok
26:37:00	Capt	तिम्रो साइड तिर हेर है,………heading……..heading is always……. It is like 340….330 त्यस्तो हुन्छ है ।
	F/O	हजुर
26:46:00	Capt	तलैबाट जानुपर्छ जस्तो छ हौ……हेर त……हई
	F/O	हो
	Capt	तिम्रो साइड तिर देखि राको छ नि?
	F/O	अँ………..अतिकति……….अँ
	Capt	……….देखिराको छ क्या……….
	F/O	अँ………..
27:02		अतिकति go down to 10, just…….
		Speed, speed'
27:08		Contd
	Capt	त्यहाँ देखिएको छ क्या डाँडाहरु…….देखिएको छ तिम्ले हइ?
	F/O	अतिअलि
		(speed x speed) in background
27:18	Capt	अतिकति left तिर, left तिर च्याँप त, left तिर च्याप्यो भने सजिलो हुन्छ क्या………..
27:22	Capt	Go speed, maintain that…… किनभने मेरो साइडतिर देखिएको छ हैन? यहाँ चाहि घुम्ने ठाउँ पनि छ । otherwise you can just go that हैन?
	F/O	हो
27:34	Capt	On top जाउ…….यसरी………..यसरी……….हैन?….. सधै तिम्रो पछाडी राम्रो छ भनेर confirm हुनु पर्यो कया…..
27:44	F/O	(Silently) हो
27:45	Capt	अब तिम्लाइ ……. हेर, हैन? अब तिम्रो track हरु हेर हेर अब
27:53	Capt	यहाँ देखेको छ कि छैन?

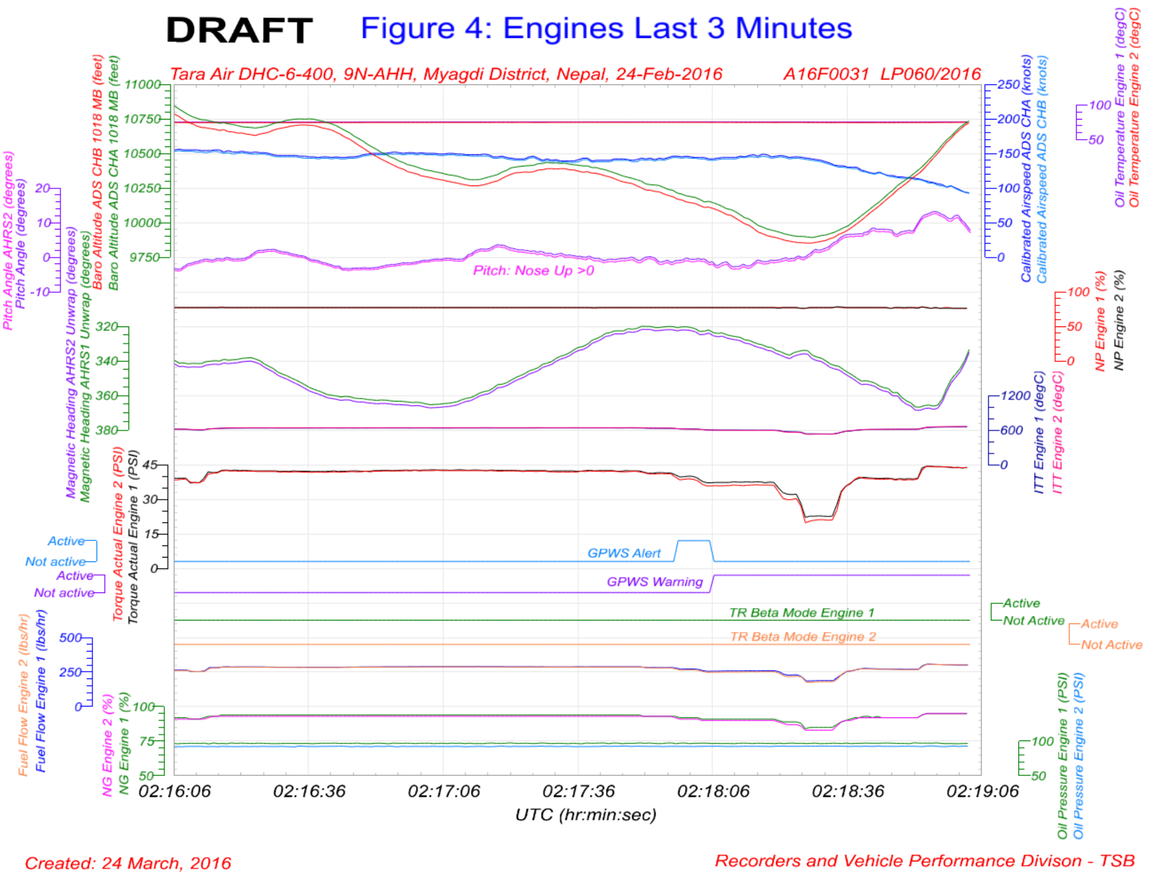
27:56	F/O	Left चाहि Visual छ ।
27:58	Capt	यस्को पछाडि visual छ कि छैन? भन्दाखेरी त्यहाँ माथि हेर त ...... त्यहाँ माथि
28:05	F/O	(Some what relaxed and open) त्यता चाहि हैन यता अलिअलि देखिन थालियो
28:08	Capt	(उत्साहित मुद्रामा) अँ...... Exactly.....त्यतै त्यतं तिर लाग्ने अब
28:12	Capt	तर तिमि जाने track चाँही left तिर हो है फेरि......make sure that
	F/O	left तिर.....
28:22	Capt	आज त ! .... 105 भन्दा तल नजाउ तर यतातिर clear हुन्छ ।
28:33	Capt	हेर त हई
	F/O	....
	Capt	Ok, good now.
28:35	Capt	हाम्रो जाने track पनि त्यतै हो नि हैन?
	F/O	हजुर
28:39	Capt	यसरी...... यसरी जाउ क्या .... भएन भने flaps लिएर यो डाँडा .... देखिएको छ हई ?
	F/O	हजुर
28:50	Capt	डाँडाडाँडाहरु ताक्दै, तिमी चाहि नि track चाहि खासमा यतातिर हो हैन? अब तिम्ले नदेखेको हुनाले..... किनभने यतातिर मैले देखिराको छु हैन?
	F/O	हो
29:06	Capt	तिम्रो साइड तिर हेर है ....
29:08		Terrain, Terrain'
29:10	Capt	If I cannot see in the your right side ....., I just make left turn है ।
29:18		Pull up'
29:22	Capt	Don't worry, don't worry
	Capt	हँ........ I have control है......
	F/O	You have control
29:24	Capt	तिम्रो साइड हेर त ..... देखिन्छ?
29:25	F/O	Right त visual छैन सर (Panic) पुरै
29:29	Capt	छैन हई?
	F/O	छैन
29:33	Capt	Ok, I can see the हैन त ?
		Pull up, pull up'
29:45	Capt	Ok,....... Landslide आयो है.........
29:54	Capt	What I will do is now, I will turn to heading of Lette है.......
30:02	Capt	Ok, I will climb है अब
30:06	Capt	Ok, turning left
30:08	Capt	तिम्रो साइड तिर हेर है .....
30:10	Capt	तिम्रो साइड तिर हेर है .....
30:12	F/O	Side तिर त छैन
30:13	Capt	छैन हई??
		(CVR recording समाप्त)

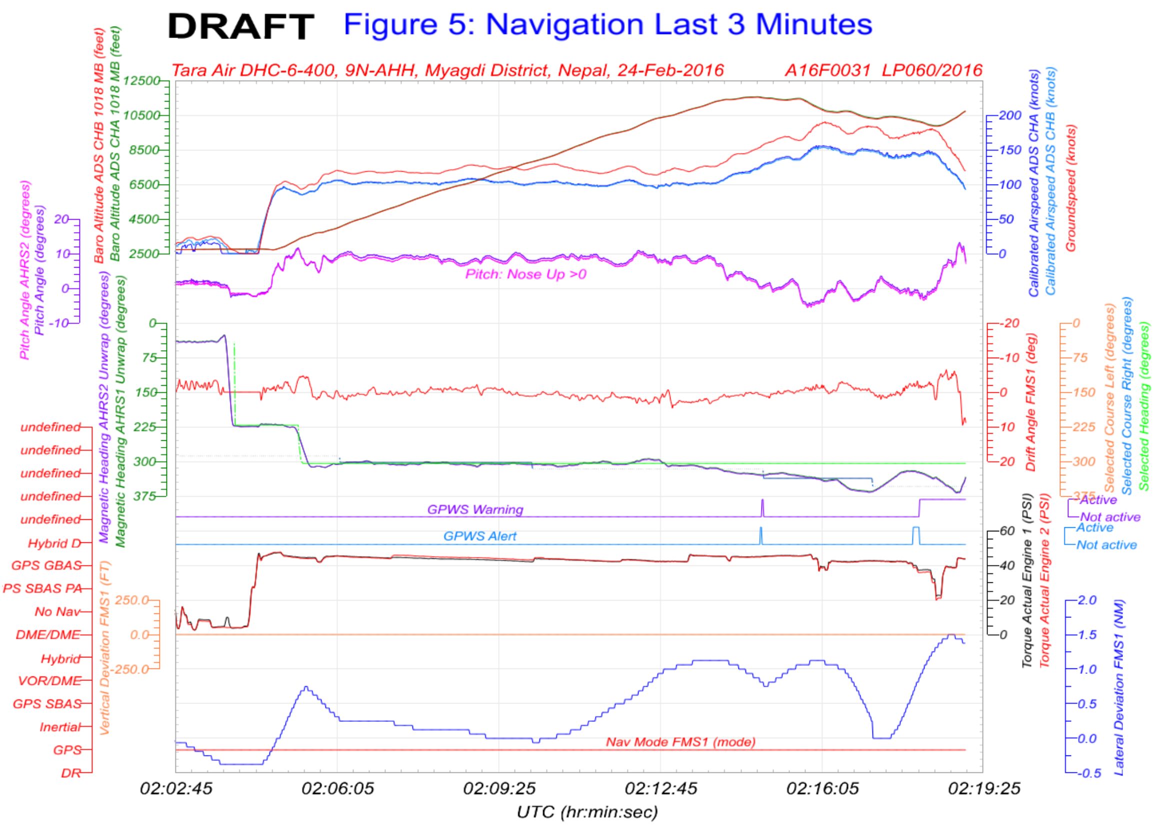
3. FDR


DRAFT
Figure 1: Entire Flight Overview
Tara Air DHC-6-400, 9N-AHH, Myagdi District, Nepal, 24-Feb-2016
A16F0031 LP060/2016
Master Warning 2
Master Warning
Pitch: Nose Up >0
Roll: Right >0
GPWS Warning
Right Mic KEY
Left Mic KEY
GPWS Alert
Flap Position
UTC (hr:min:sec)
Created: 24 March, 2016
Recorders and Vehicle Performance Divison - TSB


DRAFT
Figure 2: Overview Last 3 Minutes
Tara Air DHC-6-400, 9N-AHH, Myagdi District, Nepal, 24-Feb-2016
A16F0031 LP060/2016
Pitch: Nose Up >0
Roll: Right >0
GPWS Alert
GPWS Warning
UTC (hr:min:sec)
Created: 24 March, 2016
Recorders and Vehicle Performance Divison - TSB

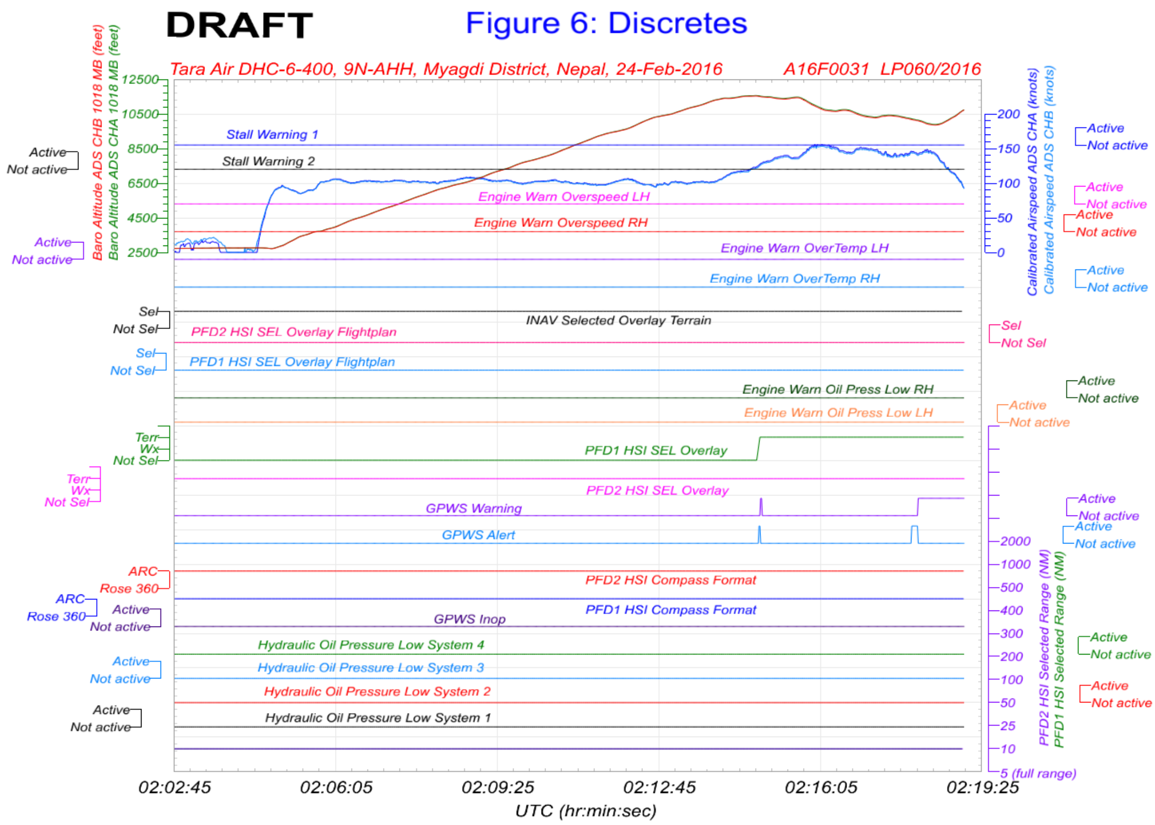

DRAFT
Figure 3: Controls Last 3 Minutes
Tara Air DHC-6-400, 9N-AHH, Myagdi District, Nepal, 24-Feb-2016
A16F0031 LP060/2016
Pitch: Nose Up >0
Elevator: Nose Up >0
Roll: Right >0
Stab Trim: Nose Up >0
GPWS Alert
GPWS Warning
UTC (hr:min:sec)
Created: 24 March, 2016
Recorders and Vehicle Performance Divison - TSB


DRAFT
Figure 4: Engines Last 3 Minutes
Tara Air DHC-6-400, 9N-AHH, Myagdi District, Nepal, 24-Feb-2016
A16F0031 LP060/2016
Pitch: Nose Up >0
GPWS Alert
GPWS Warning
TR Beta Mode Engine 1
TR Beta Mode Engine 2
UTC (hr:min:sec)
Created: 24 March, 2016
Recorders and Vehicle Performance Divison - TSB



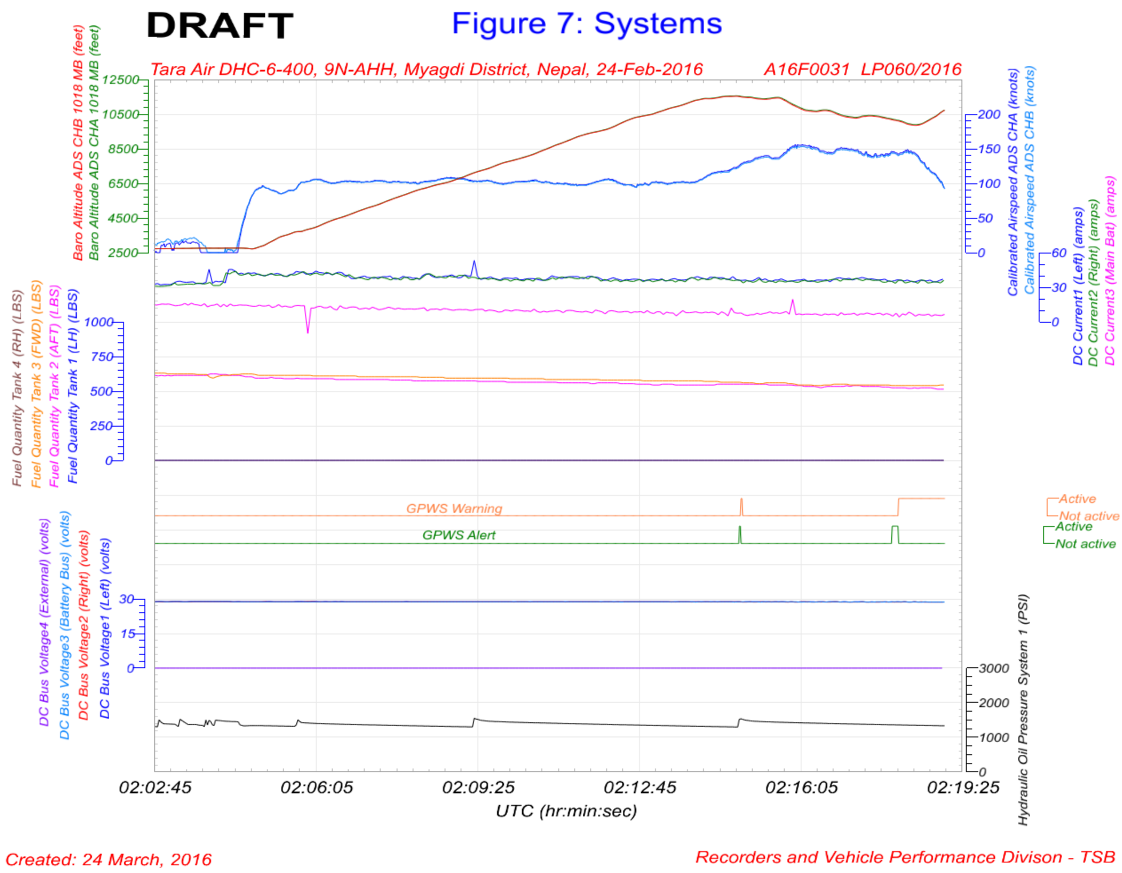
Created: 24 March, 2016

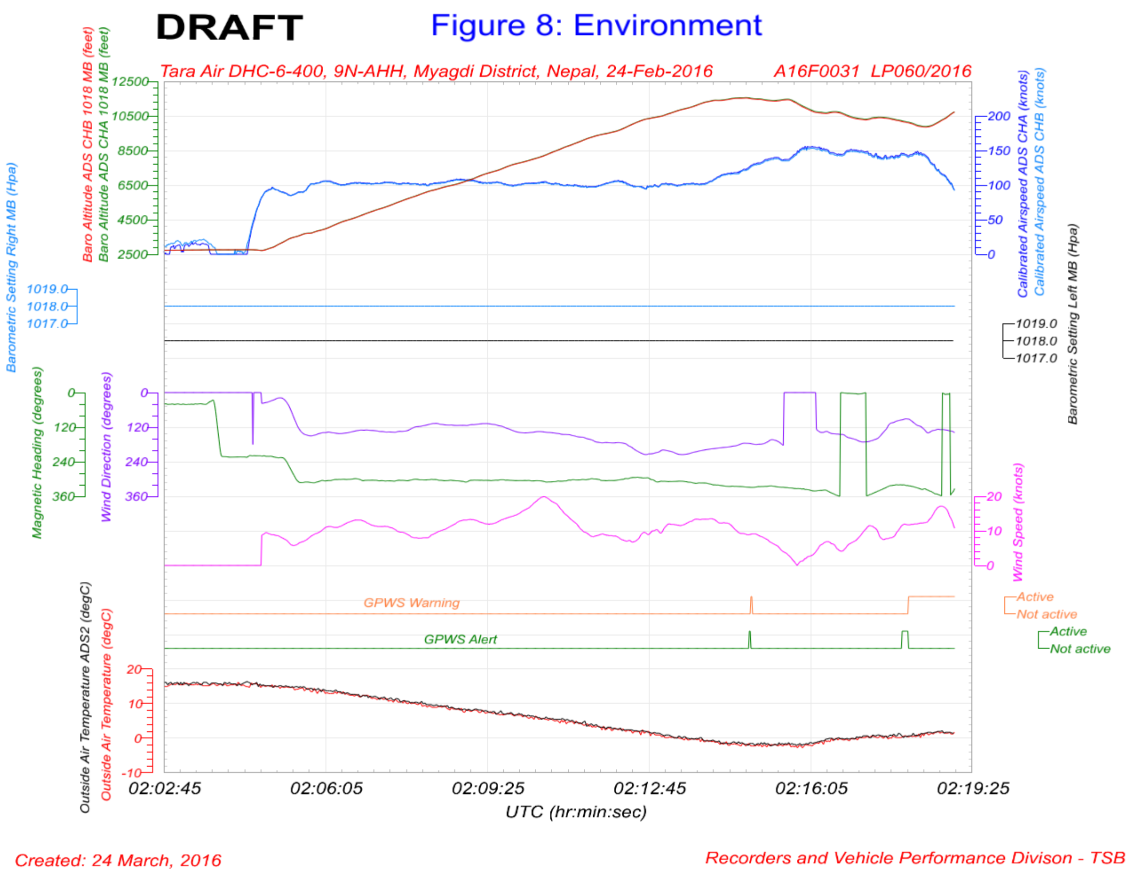
Recorders and Vehicle Performance Divison - TSB



Created: 24 March, 2016

Recorders and Vehicle Performance Divison - TSB


DRAFT
Figure 7: Systems
Tara Air DHC-6-400, 9N-AHH, Myagdi District, Nepal, 24-Feb-2016
A16F0031 LP060/2016
Baro Altitude ADS CHB 1018 MB (feet)
Baro Altitude ADS CHA 1018 MB (feet)
Calibrated Airspeed ADS CHA (knots)
Calibrated Airspeed ADS CHB (knots)
DC Current1 (Left) (amps)
DC Current2 (Right) (amps)
DC Current3 (Main Bat) (amps)
Fuel Quantity Tank 4 (RH) (LBS)
Fuel Quantity Tank 3 (FWD) (LBS)
Fuel Quantity Tank 2 (AFT) (LBS)
Fuel Quantity Tank 1 (LH) (LBS)
GPWS Warning
GPWS Alert
Active
Not active
DC Bus Voltage4 (External) (volts)
DC Bus Voltage3 (Battery Bus) (volts)
DC Bus Voltage2 (Right) (volts)
DC Bus Voltage1 (Left) (volts)
Hydraulic Oil Pressure System 1 (PSI)
UTC (hr:min:sec)
02:02:45
02:06:05
02:09:25
02:12:45
02:16:05
02:19:25
Created: 24 March, 2016
Recorders and Vehicle Performance Divison - TSB


DRAFT
Figure 8: Environment
Tara Air DHC-6-400, 9N-AHH, Myagdi District, Nepal, 24-Feb-2016
A16F0031 LP060/2016
Baro Altitude ADS CHB 1018 MB (feet)
Baro Altitude ADS CHA 1018 MB (feet)
Calibrated Airspeed ADS CHA (knots)
Calibrated Airspeed ADS CHB (knots)
Barometric Setting Right MB (Hpa)
Barometric Setting Left MB (Hpa)
Magnetic Heading (degrees)
Wind Direction (degrees)
Wind Speed (knots)
GPWS Warning
GPWS Alert
Active
Not active
Outside Air Temperature ADS2 (degC)
Outside Air Temperature (degC)
UTC (hr:min:sec)
02:02:45
02:06:05
02:09:25
02:12:45
02:16:05
02:19:25
Created: 24 March, 2016
Recorders and Vehicle Performance Divison - TSB

DRAFT Figure 9: Latitude / Longitude